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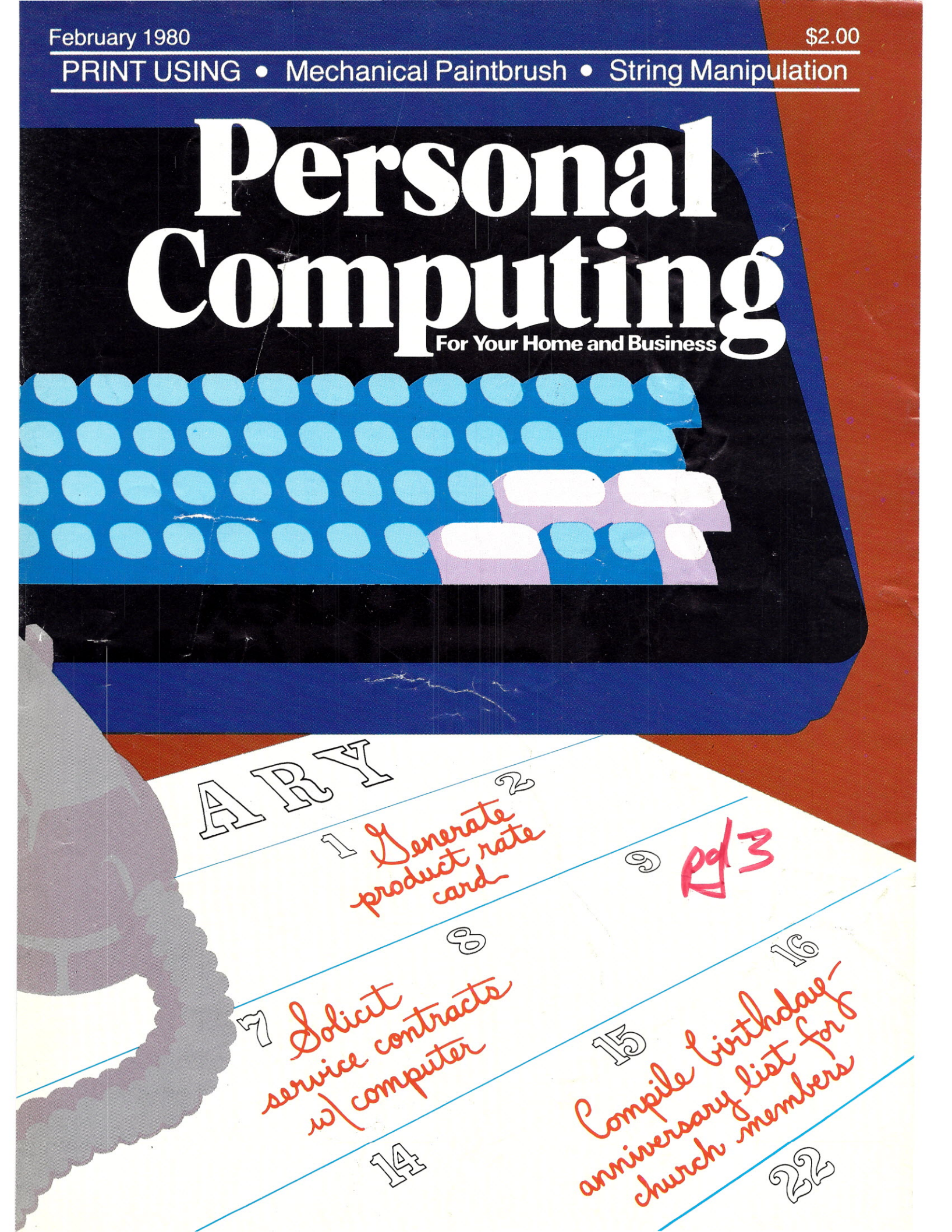

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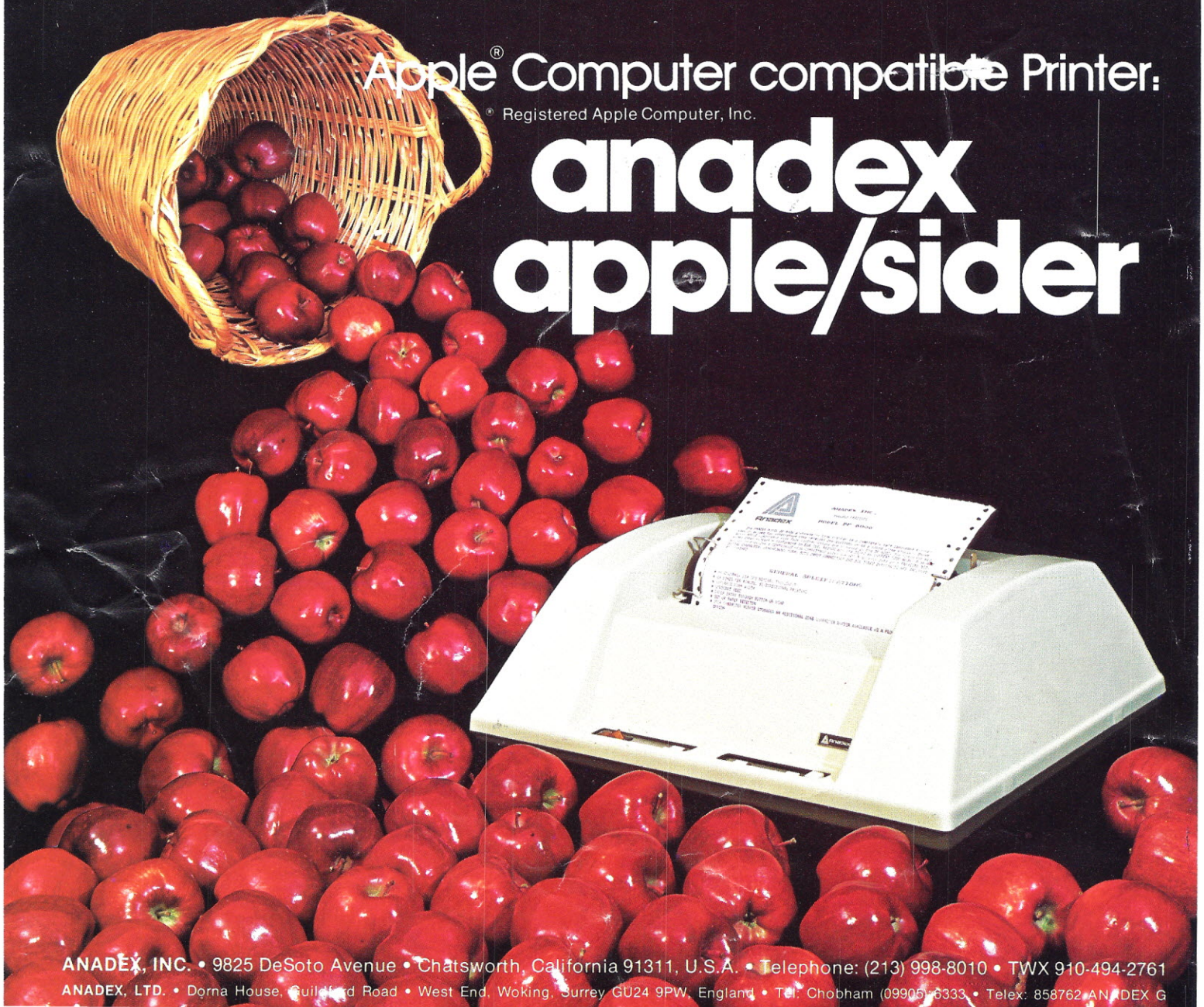

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CIRCLE 3

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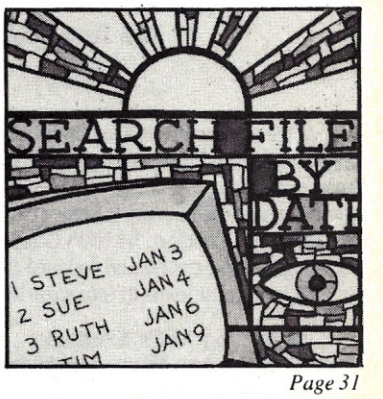

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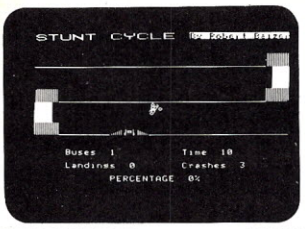

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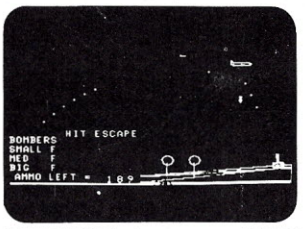

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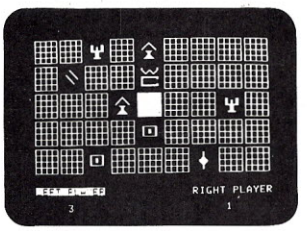

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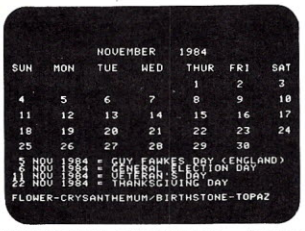

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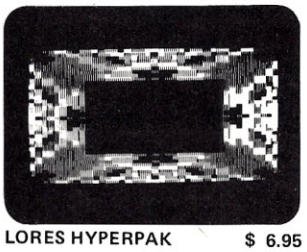

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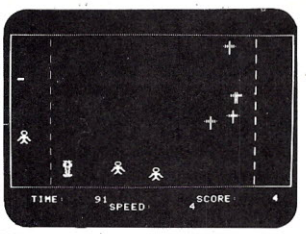

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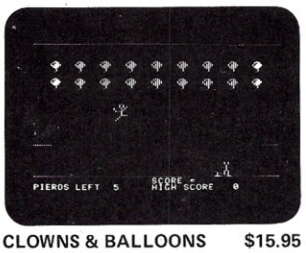

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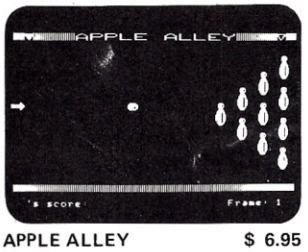

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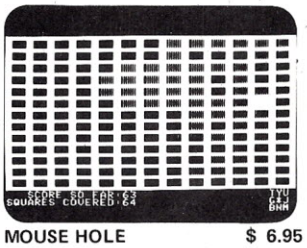

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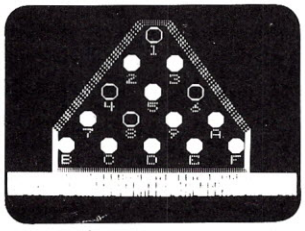

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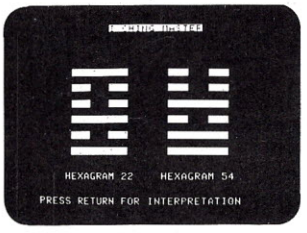

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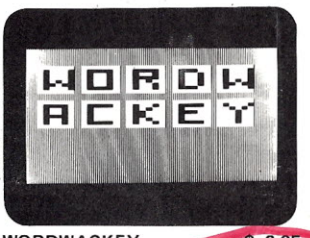

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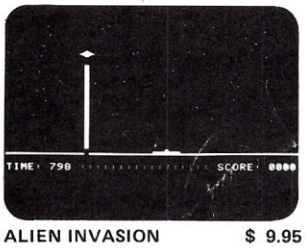

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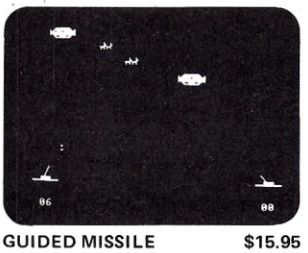

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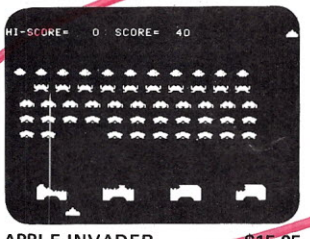

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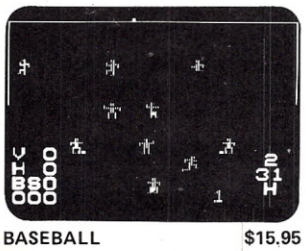

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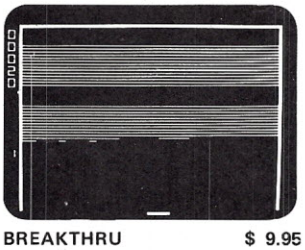

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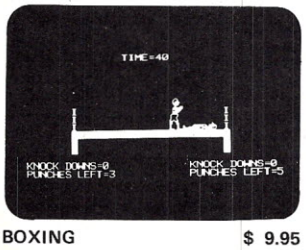

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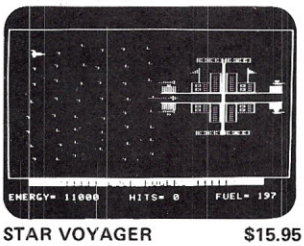

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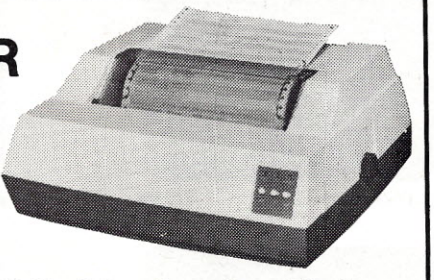

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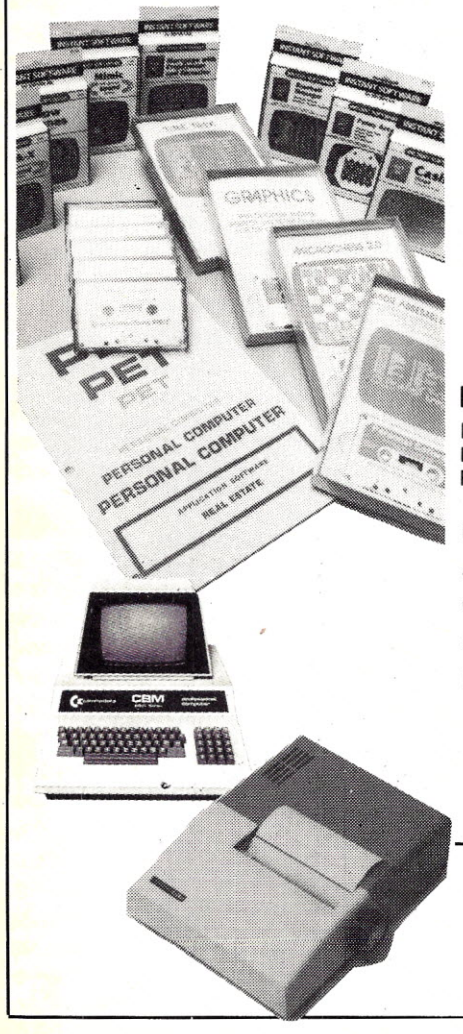

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CIRCLE 7

FEEDBACK

Real Estate Market: Bulls and Bears

Dear Sir:

As an attorney, real estate investor and former IBM programmer/analyst, I eagerly opened your October 1979 issue to the "Viewing Real Estate Investments" article. A few moments later my anticipated pleasure turned to nausea.

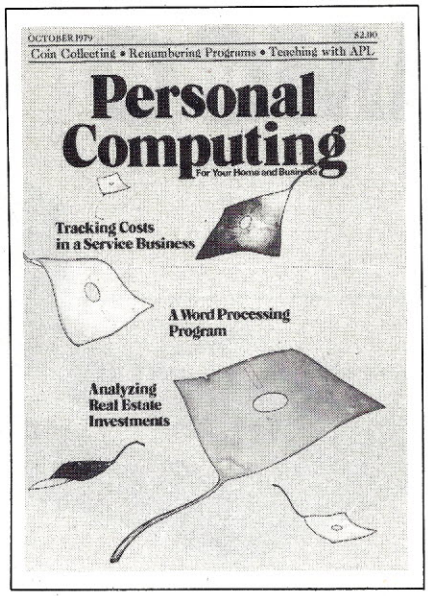
Ignoring for a moment the programming errors which distort operating expense, closing costs and other figures, let's summarize the purchase and projection as presented in the sample run:

The investor is buying a four-unit rental property for $142,000 with an out-of-pocket acquisition cost of $40,040. After payment of operating and mortgage expenses, the investor has a negative cash flow of ($207.95). ("Negative cash flow" means that the rents from the property cannot pay all the expenses. In this case the investor has to dip into his personal savings for $207.95 each month, or $2495.50 annually, to pay all the bills.)

Based on these figures, the program calculates the investor's first year rate of "return on investment" at a phenomenal 44.379261% and a growth of $17,769.46! This is absurd. The "investment" is $40,040 and his real return is negative ($2495.50). He has *lost* money, not made money.

The author has pumped up his rate of return on investment by including speculative increases in equity and tax savings. These figures have a role in investment analysis, but not here. They should properly be used in projections involving retention of the property for a finite number of years with termination of the investment at the end of the period. Even then these figures would be greatly altered by discounted present/future value calculations, inflation rate projections, reduced basis, depreciation recapture, disposition expenses, capital gains and ordinary income taxes, etc. — all of which are too complex for this letter, but not too complex for a microcomputer program.

None of your readers expects a complicated program in an area of interest to only a few readers, but all of your readers expect any published program to be accurate. By misapplying investment language and formulae, the author has transformed a financially unattractive property into a lucrative one. An over-valued property becomes a money machine. A microcomputer program, with its aura of magic and its imprimatur of doctrinal accuracy, has turned an ugly frog into a handsome prince.



I am very much afraid that inexperienced investors might plug data into the program relevant to a particular property in which they might be interested and, on getting a "return on investment" figure displayed which is higher than the inflation rate, the bank rate on savings accounts or whatever, would then believe that the property was a good buy.

While real estate investment analysis does involve some subjective factors, there are enough "hard" elements which go into the determination of property value that a computer program could be very useful. Your author, however, has not written that program. The "Real Estate Evaluator" is valueless. If it were merely valueless, I would ignore it and this letter would not be necessary, but I am afraid that your readers (particularly those who are real estate brokers) might use it, rely on it, and cause themselves (or, in the case of brokers, their clients) severe financial injury.

Although the "return on investment" calculation is the greatest distortion in the program, there are several other items which I feel I should mention briefly.

Operating Expenses: Insurance costs are buried in the monthly mortgage payment; they should be split out and listed separately. Where is the management expense? Even if owner-managed, the owner's time has a value and should be included; this is separate from and should not be confused with the return on investment. The article says "expenses fall in the range of 5 to 15% of rents." Not so. Nationally, operating expenses before debt service will probably run 45 to 55% of rents. The $67.83 per month figure for maintenance is too low to include landscaping, rental brokerage commission, legal and accounting fees, advertising, redecorating and, most especially, the cost of repair and replacement of limited-life items (e.g., carpets and appliances). (The IRS permits depreciation deductions for a very specific reason — things depreciate in value and utility over time.)

Gross Rental Income: The article mentions an allowance for vacancies of 5%, but the program doesn't reflect it. What about collection losses from bad checks, rent withholding, eviction costs, etc. A 5% factor is arbitrary; the factor should be based on local experience. The article presumes that increases will equal cost increases. Rent increases invariably lag behind cost increases.

Closing Costs: The article says closing costs are a percentage of the money lent. The program figures them as a percentage of the purchase price. The article indicates that the non-deductible closing costs are generally small. They are not unless one believes four-figure dollar amounts are small.

Depreciation: The program assumes a 20 year useful life for the building for tax purposes. IRS might disagree. The article says accelerated depreciation "can create tax problems if you sell in less than 10 years." Accelerated depreciation will *always* create tax problems on property purchased after 1969. The

excess depreciation will be recaptured as ordinary income and taxed accordingly. This program will not work for non-residential rental property; the laws governing depreciation are different.

Despite the author's assertion, IRS will not permit the current deduction of "points" paid to acquire a mortgage. This expense must be deducted ratably over the period of the mortgage loan.

In summary, I believe that the program is without value. More importantly, I believe that if your readers should use the program and rely on it for guidance, they could make serious financial errors.

Thomas Philip Degnon
Boston, MA

Author's Reply: The Real Estate Evaluator program made no attempt to analyze a large apartment complex. However, it is excellent for houses — or 4-plexes.

In dealing with the "Return-on-Investment," one needs simple math to arrive at my results:

$14,200.00	Inflation growth @ 10%
5457.28	Tax Savings
607.68	Loan Payback
$20,264.96	
−2,495.50	Negative Cash Flow
$17,769.46	Net Return

On October 1, 1979, CBS Evening News showed the Bank of America graph of property values over the last 10 years, and projected the future. 10% is very conservative. Of course, any buyer should seek to get the lowest possible price. The real key is leverage which allows high returns.

$$\text{10\% Inflation} * \frac{\text{\$100M (value)}}{\text{\$20M (equity)}} = \text{50\% R.O.I.}$$

On depreciation, I have been unable to get a firm schedule from the IRS. For example, carpet may depreciate over a range of 5 to 10 years. Finally, "Conventional Wisdom" dictates the use of straightline depreciation, but it totally ignores inflation. The fact is that at 15% inflation, the dollar loses 1/2 of its value every 4.7 years. Deferred taxes are paid in cheaper dollars — paying a higher rate can be a bargain, like interest on a loan.

The one concession that I have to make in "Prop. 13;" Californians' property tax can only go up 2% a year. This *does* cut the growth in costs.

In summary, while I regret Mr. Degnon's discomfort because of my deviation from "Conventional Wisdom," I suggest that any potential users try the program on a house purchased in the last 3 years. The user can then plug in *known* facts and see for himself the value of this program.

Corrections and Improvements

```
320 D6= (D*P4/100) + C1 + C*F :
REM Corr.
901 !
902 ! "Total Annual Cashflow (w/tax
break)"; T5 + C2*12
903 !
```

Delete line 1150 — *Larry Severson*

Genealogy Program Translated for Altair

Dear Sir:

Heaps of praise for John Armstrong's "Roots and Branches" article, (September 1979). The problems encountered translating TRS for my MITS Altair system were trivial compared with the gratification of seeing the program run. Three generations of genealogists have been gathering data in our family. Now, at last those efforts can be illustratively shared with all family members. It makes a superb demonstration program, too. Some of the problems I encountered are described below.

In Program 2, lines 90 and 100 (used to strip surplus trailing spaces off names) and gave me trouble. First, an empty name field (i.e., no married name) yields Y=1 which subroutine 3350 changes to Y=0. Additionally, a *full* name field yields Y=0 which the subroutine doesn't change. But (at least in my dialect of BASIC) Y=0 is an illegal function if used in an N1$(X)=LEFT$(N1$,Y) command. Furthermore, use of B1$ to determine Y truncates the married name of a twice-wed-woman and any last name which includes a "JR", "II", etc. I solved the latter problem by using B2$ to determine Y (B1$ is then a superfluous variable) for all three name segments. The other part of the problem I resolved by rewriting line 3350 as:

```
3350 IF Y=0 THEN Y=24:RETURN
ELSE IF Y>1 THEN Y=Y-1:RETURN
ELSE RETURN
```

This works just fine even for 16 byte last and married names.

I encountered erratic performance during the EDIT mode, which I diagnosed as due to using C() to represent both children's ID # and change #. I changed to CI(X3) for variables in line 1040 and 1070. This array was then included in line 50 where C(28) was changed to C(13). I found additional dimensioning in line 50 was required to properly construct a tree displaying all data. Specifically needed is C0(13), C1(13), . . .C9(13) to accommodate the variables occurring in lines 2340 through 2710 when encountering families of more than 10 children.

I've added a number of handy embellishments to the program too:

- An added 7th option to access data by ID number.
- Entry of a "0" for any numerical choice returns the initial menu.
- Entry of an "*" to most other prompts also returns the initial menu.
- An alphabetized list of names on file with their ID numbers.
- A program for making backup copies of the random file.
- Automatic tagging of data with a revision date.
- Optional tagging data with footnotes.
- Optional display of ID numbers in the data displays.

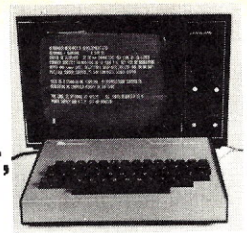
I found it advantageous to designate the first "name" in the file as "NO DATA ON FILE". The ID # for this record can be entered wherever the appearance of that statement would be appropriate.

Again, I thank *PC* and John for this excellent contribution!

John Chase Reed
Bellevue, WA

By Netronics

ASCII/BAUDOT, STAND ALONE



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The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

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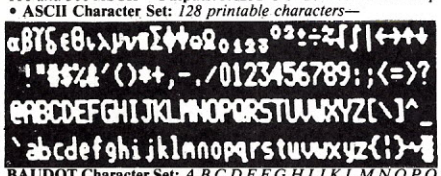
When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: *1.5 P/P into 75 ohm (EIA RS-170)* • **Baud Rate:** *110 and 300 ASCII* • **Outputs:** *RS232-C or 20 ma. current loop* • **ASCII Character Set:** *128 printable characters—*



BAUDOT Character Set: *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

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CIRCLE 11

"G" is for Graphics

Editor's Note: Reader Candy Jens of Belmar, NJ, wrote to us about a problem she encountered with our " 'G' is for Graphics" program (June 1979): "When I draw a picture for a letter, do the next few, then type the letter again, the picture I drew shows up, as expected. After I've drawn several letters and then write to tape, the recorder seems to be picking up something, and the screen says 'file written.' But when I run the program, read back the tape, then type a letter, I get 'Please draw . . .' instead of the picture. What's wrong?"

Author Mark Zimmermann suggested using the following short program to read the data tapes:

```
10 OPEN 1
20 GET #1,A$:
   PRINT A$;:GOTO 20
```

After trying this program, Jens said, "I found there was no data. On rereading the program subroutine for writing to tape, I found the culprit; there's a typo in Line 4020." The line should read:

```
4020 FOR I=0 TO 255:IF Z$ (I)= " "
     GOTO 4100
```

(The Z$ subscript was omitted in the printed listing.)

With this change, Jens said, "the program works great!" —*D.W.*

Satisfied Sorcerer User

Dear Sir:

Being an inveterate hardware hacker, I cannot leave well enough alone. My Sorcerer computer (see November 1979 *PC*) is now a disk system. The youthful personal computing industry has come far since the pioneering times of just a few years past, as attested to by my experiences.

My system now consists of hardware from several sources; the Sorcerer computer (Exidy), an Econoram IIA 8K RAM board (Godbout), a Doubler disk controller (Micromation) and a single Shugart 801 drive (Morrow/Thinker Toys). *Everything went together without a hitch and worked properly at once!*

The Sorcerer-Micromation CP/M operating system is well worth the cost (available from Computer Mart of Waltham, MA, a Sorcerer specialist). Why re-invent the wheel?

Accolades to the above-mentioned firms as well as MiniMicroMart in Syracuse, NY, from whom I purchased some of the hardware. Quality merchandise, rapid delivery and helpful technical back-up mark all the aforementioned.

Charles H. Strom
New York, NY

Slight of Screen

Editor:

Little new ever happens on the Apple II text screen. Once you've seen normal, inverse and flashing characters, you've seen it all.

If you would, however, like to see something new for a few seconds, write a short Applesoft program to print out the following in the top left corner of the screen (home). The letters below the characters tell whether the character is normal, inverse or flashing.

```
  – U @ – T @ L @ O
  n f n n f n f i i
```

Then (don't clear the screen) type:

```
POKE 1032,4:CALL 1024        (return)
```

Don't get dizzy!

Greg Robbins
Piedmont, CA

Editor's note: The following Applesoft program prints Robbins's "code word" in the screen's home position:

```
100 HOME
110 PRINT "–";
120 FLASH
130 PRINT "U";
140 NORMAL
150 PRINT "@–";
160 FLASH
170 PRINT "T";
180 NORMAL
190 PRINT "@";
200 FLASH
210 PRINT"L";
220 INVERSE
230 PRINT "@O"
```

—*D.W.*

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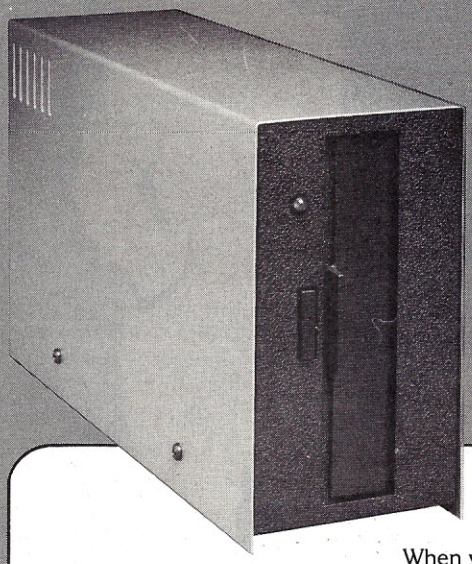

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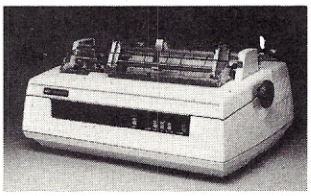

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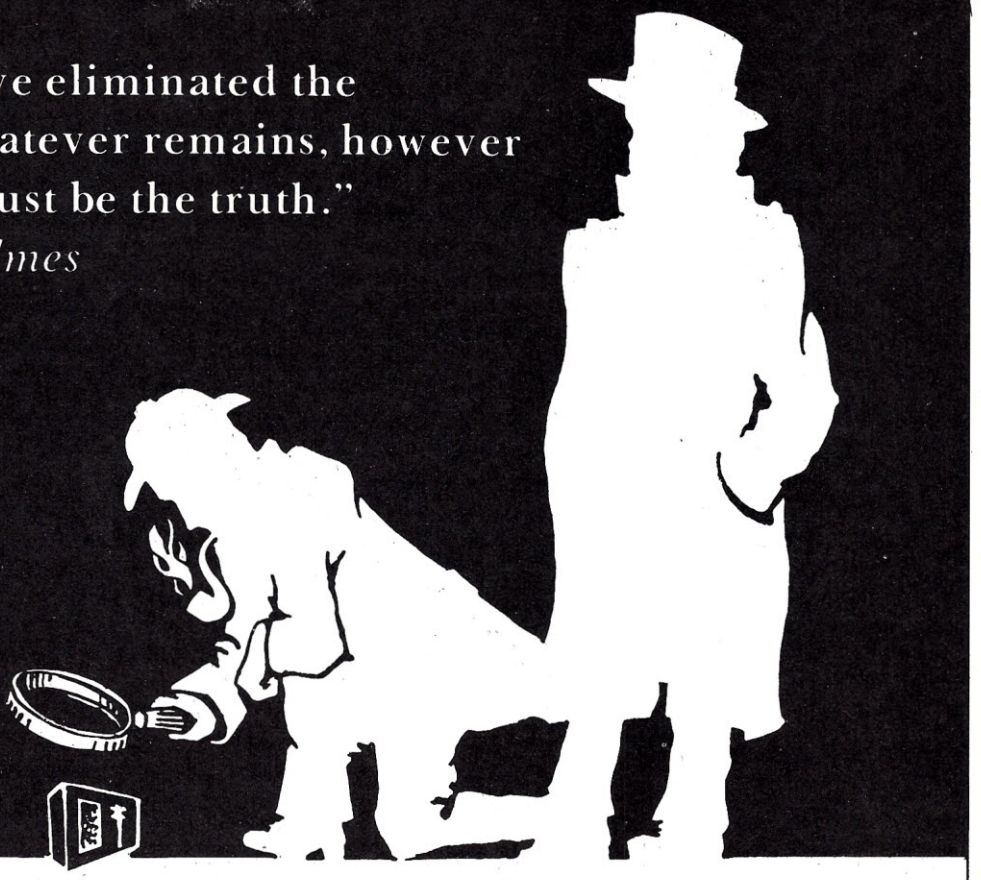
CIRCLE 9

"When you have eliminated the impossible, whatever remains, however improbable, must be the truth."
— *Sherlock Holmes*



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CIRCLE 10

RANDOM ACCESS

FCC Sets RF Standards for Home Computers

Home computers manufactured after July 1, 1980, will have to meet radiation emission limits adopted by the Federal Communications Commission. By setting these limits, the FCC hopes to avoid an interference problem similar to the one encountered with CB radios several years ago, according to the First Report and Order released on the standards.

Apparently, the new rules will affect manufacturers more than consumers. Comments from several companies indicate a possible but small rise in cost of computers. Criticism on the rulings stems from the time limit allowed manufacturers for updating their products and the report's vagueness in classifying computers as "commercial" or "personal".

These regulations only affect computers containing their own monitors. Rules governing computers with TV interface devices are now in the proposal stage.

The report, better known as Docket 20780, details regulations aimed at curbing broadcast and TV interference caused by excessive radiation emissions from computers. These rulings will not be retroactive, said the FCC. Consumers already owning a computer will not be required to update their systems to the new standards.

Thirteen companies have filed petitions for reconsideration of the new rulings, according to Art Wall, of FCC's Radio Frequency Devices Branch. The petitions question the time allowed for implementing the rules, along with the definitions used, said Wall.

"Comments have been on both sides of the fence," said Lawrence C. Middlekamp, chief of FCC's Research Branch of the Laboratory Division. "Some of the manufacturers who want to get into the market now say the limits are too tight. Parties already complying with the limits claim they're too liberal."

Among those filing petitions are Apple Computer, Inc., Tandy Corp., CBEMA (Computer Business Equipment Manufacturer's Association) and Atari.

Apple Computer said they found the report ambiguous. "There was considerable confusion over the question of what was a commercial computer and what was a personal computer," said Rod Holt, vice-president of engineering.

The FCC divided computers into Class A — computers intended for a commercial, industrial or business environment; and Class B — computers marketed for home or residential use. Class A computers can emit more RF radiation without causing interference, says the report.

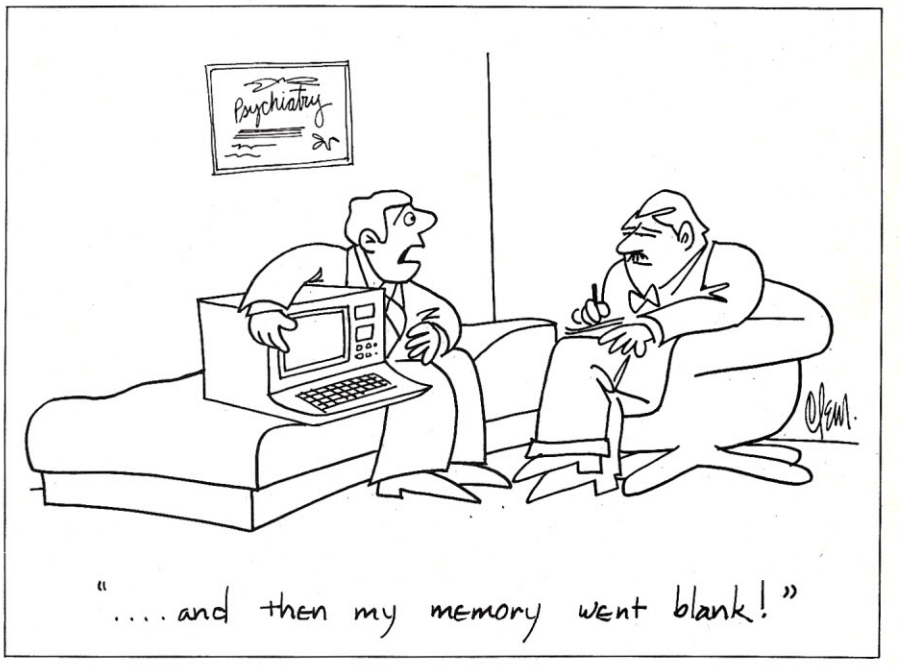
Class B limits are expected to protect home TV receivers from computers located 10 meters away with at least one wall in between. Ten meters was considered representative of the average separation between a TV and a computer in different households.

"The limits we are trying to apply will not guarantee that if this computer sets right next to a TV receiver it will not show interference. We are trying to be realistic and reasonable," explained Middlekamp.

The majority of Apple computers out in the field now are not in homes, Holt said. What Apple means by a personal computer is one dedicated to an office, desk or individual.

Holt said the impact of the current rulings would be hard to assess because in a sense they are not final until the FCC reviews the petitions for reconsideration. He added however, that these regulations would tend to push computer prices up.

The FCC never re-opened discussion allowing personal computing companies to comment on these rulings, continued Holt.



And, the commission has not considered the effect of add-on peripherals on radiation emission from computers.

FCC spokesmen said the commission is not working on the question of add-on peripherals right now.

Responsibility of the consumer when buying a computer is also a point to be considered, said Holt. If Apple manufactures two versions of the Apple, one suitable for commercial use and another for personal use which is properly shielded, is it up to the consumer to make the right purchase? "I am personally unable to evaluate the impact of these regulations on the industry until the problems I've mentioned are dealt with by the FCC," concluded Holt.

John Shirley, vice-president of the Computer Operations Division at Radio Shack, said he doesn't think the new rulings will have much effect on the consumer. He doubted there would be much increase in cost of the computer, or much effect on performance. "It's just going to be a bit of effort for everybody in the computer business, from IBM down, to meet the regulations. The only thing we feel about it is the FCC hasn't given sufficient time to make the changes.

Commodore is not affected by the new limits, according to Dennis Barnhart, vice president of marketing. Commodore's Pet, enclosed in a metal housing, passes all FCC regulations, he said.

Texas Instruments requested a waiver of earlier FCC rulings which affected computers interfacing to TVs. Computers without their own monitor but with modulators, are subject to Class I TV device rules, which TI contends are too restrictive to market computers at reasonable cost. Should the rules be changed, said a statement issued by TI Consumer services, they would allow home computers to be marketed with a modulator for connecting the computer to a TV, eliminating the need for a monitor. However, TI will continue to market the TI-99/4 with the monitor at this time.

CBEMA filed a peitition with FCC asking for reevaluation of the deadlines, according to Jeff Wood, Director of CBEMA Communications. Wood said CBEMA doesn't challenge the need for standards, but feels the deadlines are unrealistic.

CBEMA's concern is primarily with commercial computers and office equipment, said Wood.

Middlekamp said he could not comment on whether or not the FCC is going to reconsider due to the petitions. And at present, the July 1, 1980 date is still effective. "That of course could change if the decision is made from comments that the lead time is insufficient," he added.

by Marjorie Morse

Smithsonian Undertakes Massive Inventory

Within four years 78 million specimens held by the Smithsonian, the world's largest museum complex, better be recorded in the institution's computer system, says Philip Leslie, the Smithsonian's central registrar. The full inventory has to be completed by June 1983.

Congress imposed the monumental task. A physical inventory of collections has to be matched against catalog information to ensure the existence of every item from Bell's telephone to moon rocks, from old masters to microscopic marine life.

The mammoth physical stocktake has just started, though the task of collections management using computers began some time ago. Smaller art collections like that at the National Collection of Fine Arts have already been recorded in "machine-readable" form. The Air and Space Museum is also well on its way to computerizing its inventory. Others, like those collections in the Museum of Natural History, in excess of 60 million specimens, present much more complex problems.

Many collections managers have worked with the Smithsonian's Office of Computer Services in using the computer to handle records retrieval and building records for some of the objects in their collections under what Leslie calls a "subject of an object" concept — like the subject indexes common in literature but not in the museum world. Skeletal records developed during the inventory can be expanded to serve such retrieval needs for objects not yet covered fully by computerization.

"We're trying to keep up with current collections and gradually automating these along with significant areas within collections, such as "type" collections, that will yield most benefit to museum researchers," said Jim Crockett, deputy director of the Office of Computer Services.

Each of the twelve Smithsonian museums is being allowed to tackle its inventory in its own fashion. It's Crockett's job to see that they get needed systems and programming support.

The computer center, based on a large-scale Honeywell 66/05 computer system, also handles scientific applications in the areas of data analysis, mathematical modeling and computer graphics. Researchers from all areas of the museum use computers to support their studies.

For example, these include environmental studies being conducted at the Chesapeake Bay Center and animal behavior studies at the National Zoo. Some others are anthropological and biological research in the Museum of Natural History and analysis of historical, political and art data in the Museum of History and Technology, Freer Gallery, the Conservation Analytical Laboratory and the Woodrow Wilson Center.

Routine administrative and financial management still comprise most of the workload — approximately 50 percent of the total.

Public Libraries Install Learning Modules

A pilot project at the University of California, Irvine will bring computers into public libraries to help adults learn more about science. The computers will teach mini courses on topics such as accurate measurement and concepts about the sun.

Director of the project is Dr. Alfred Bork, professor of physics and information and computer science. Dr. Bork is developing the computer learning modules with a two-year grant of nearly $200,000 from the federal Fund for the Improvement of Postsecondary Education, according to University officials.

The computers will be installed in two or three Orange County public libraries in about six months.

According to Dr. Bork, the computer material will spread into additional public locales — such as shopping centers and science museums — if the response is positive in the libraries. Furthermore, the computer-aided learning modules may be distributed to other parts of the country if the project is successful.

"Our aim is for the users of these learning modules to learn more about scientific theories, including how the theories are created and evaluated, and how they are connected to everyday experiences," Dr. Bork says.

The 10- to 15-minute learning modules, dialogues between the user and the computer, are designed for persons with little or no scientific training. However, each module will contain a certain degree of flexibility so that it can be used by many people with very different backgrounds.

As the user "converses" with the computer by typing responses to questions, the extent of the user's knowledge will be determined. For example, the computer might determine the user's knowledge of negative numbers. It will proceed accordingly with an easy lesson, or an advanced lesson.

A closer look at one series of learning modules demonstrates the nature of the information to be taught by the computers. One topic already under preparation deals with measurements. A small ruler adjacent to the computer will be used during the lesson.

The initial conversation with the computer is simple but becomes more complex as the lesson progresses. At the outset users are asked to state their height and then to measure their own little fingers.

At one point the computer offers concrete examples of the need to obtain accurate measurements in the home environment: measuring a window for a shade, a room for carpeting or a piece of cloth for a skirt.

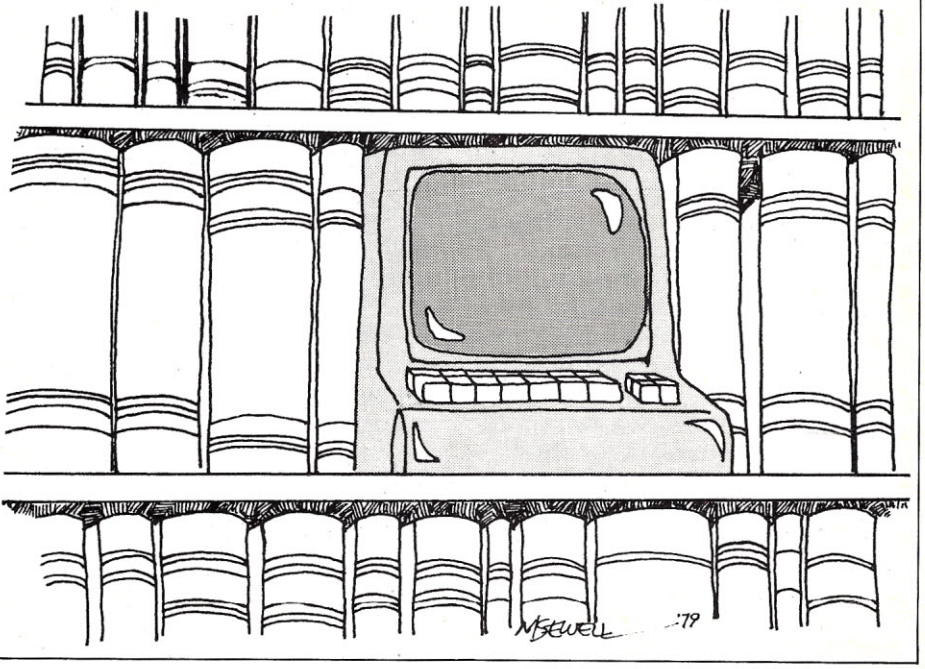
Later the user sees situations where several measurements are taken and the results do not tally, where obstacles prevent direct measurements and where the object being measured is longer than the measuring device.

The computer dialogues will be available in the test libraries on a drop-in basis rather than on a reservation system. The computers will initially run in an attract mode in which the screen flashes pictures and words designed to stimulate interest and attract potential users. Once the user sits at the computer, the program greets the person and the lesson begins.

Libraries already are becoming more media-oriented with records, tapes and films frequently being added to book inventories. However, although a few libraries have installed computers, these are not being used to increase the public's general knowledge of science.

Many scientific authorities and experts on learning are working with Dr. Bork on the development of the learning modules. Included so far in this group are faculty members from UCI, UC Berkeley, the Lawrence Berkeley Laboratory, UC Davis, Cal State Fullerton, State University of New York at Stony Brook and the University of Washington and the director of the Orange County Experience Center.

Although the initial series of mini courses are being designed primarily for unrestricted use, later they are expected to provide academic lessons for course credit. Institutions such as the local Coastline Community College, which offers courses at locations throughout the county, would be ideal for this type of learning opportunity said Dr. Bork.



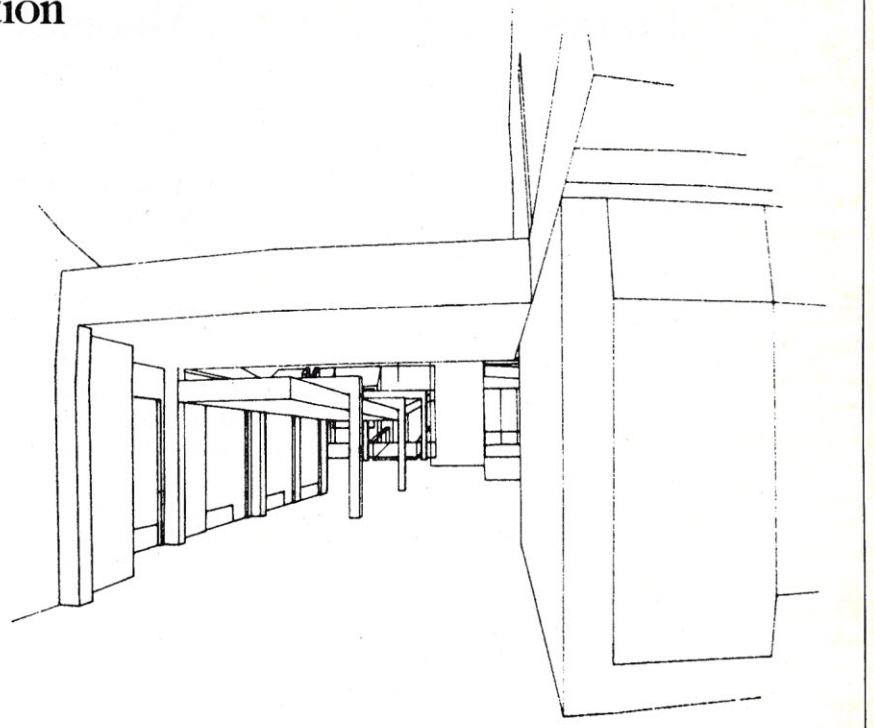
Architects and Animation

Computer animated graphics complement sketches used by architects, giving clients a visual impression of proposed buildings — from the inside.

From the artist's drawing, the computer draws a series of sketches, each from a slightly different angle, and assembles them into an animated film. The film acts as a guided tour for clients, giving them the impression they are walking through the building.

By using computer animated graphics and computer terminals, internal outlines of the building that are not shown in the artist's impression are revealed to clients. This gives added advantages of facilitating any changes that may be made to planned structures.

Easinet, a computer time-sharing service for engineers and architects established by Engineering and Scientific Comptuers Pty. Ltd. (a subsidiary of Miller, Milston and Ferris Pty Ltd.), uses a Data General Corp. Eclipse S/130 comptuer to sketch building interiors quickly on video display terminals. Dr. Barry Westlake, Easinet manager, points out that conventional artists' sketches are time-consuming and costly and do not accurately represent a full visual impact of a new building.



Architects show their clients the visual impact of a proposed building by walking them through it using computer animation. Computer drawn sketches from different angles are assembled into animated film.

Dr. Westlake notes that this work does not replace creative design efforts of the architects, but concentrates on perfecting physical details of their sketches.

In their work as structural engineers, Miller, Milston and Ferris used computer graphics for the proposed entertainment center at Sydney's Haymarket. Using the S/130 system, engineers designed the 12,000-seat auditorium with no intermediate columns. They programmed the computer to check seat positions to insure every person would have an unobstructed view.

Personal Computing Projections

In less than 10 years, more than 50% of American homes will have a personal computer system that functions as playmate, teacher, cooking consultant and financial planner, according to a recent study by researchers at the University of Southern California.

"This year, sales of microcomputers will surpass 300,000, a number that does not include calculators, minicomputers or intelligent terminals and devices," said Jack Nilles, principle investigator of the study and director of USC's Office of Interdisciplinary Programs.

"We project that 40 million personal computers will have been sold to first-time users by 1990. That would mean one unit for every two American households," he said.

The USC team began its study with an analysis of the current state of small computer technology. Any study that tries to forecast buying trends must first analyze current and projected developments in the product's technology, Nilles explained. Improvements in technology are closely related to product demand, and demand for a product is dependent on consumer perceptions of technology, cost and availability.

"Our study demonstrates that no major technological breakthroughs are needed for our projection of the buying trend to become a reality," Nilles said.

"Some innovations, however, such as low-cost mass memories, and particularly software for programming the computers to do specific tasks, may have substantial market effects," he said. "I believe improvements that can make software understandable to people who don't know how — or who don't want to learn how — a computer works will play an important role in demand.

"We found that children have less of a problem in learning software, perhaps because they grow up with the idea of computers as a part of their lives and don't

know that computers are supposed to be hard to understand.

After evaluating small computer technology, the USC team made a survey, in late 1978, of the early users and uses of the devices.

They found the majority of owners to be male, between the ages of 20 and 45, middle-class and well educated, with seven out of ten having at least a B.A. degree. Their educational background is most often in engineering, business, natural science or mathematics, but many owners said they were self-taught on computers.

Most of the owners also own other electronic devices, such as televisions, radios, calculators and stereos. The majority spent more than $4500 for their components, and the amount spent correlates to the age of the buyer.

The survey revealed that 80% of the owners used computers at work or worked closely with someone who did. According to Nilles, the high percentage reflects the Spillover Theory of Recreation, which says that people often carry their work activities into their leisure time.

The main uses for personal computers by the survey respondents were video games, board games and text editing.

"Every computer maker provides video games, but whether people buy small computers just for the games is another question." Nilles said. "On the other hand, a purchaser may buy a computer for the games and then use it for other things."

Since the USC survey was conducted, the market has shifted strongly toward small business and professional users. According to Nilles, this trend will grow.

"The consumer computer market will grow more slowly at first, paced by the availability of good software," he said.

The survey on users and uses of personal computers is only the first phase of a three-part project funded by a grant from the National Science Foundation.

The second phase of the project will be an investigation of the social impact of personal computers and an examination of the possible policy problems that may arise. Third, the USC team will try to determine which governmental agencies should be involved in policy problems.

Broadcasting on Infrared Waves

Research scientists at IBM have demonstrated a novel way of transmitting computer data without wires in an enclosed environment — by broadcasting on infrared wavelengths.

The experimental work may prove useful for the increasing number of computer systems that employ small, local terminals performing individualized tasks, such as sorting checks, controlling movement of inventory or supervising the activities of industrial robots.

Wireless data transmission may be especially suitable in large room offices and factory or warehouse environments.

The scientists visualize an infrared data communications system this way: each terminal on the floor of the working area would be equipped with light-emitting diodes (LEDs) for sending the infrared signal and photodiodes for receiving.

LEDs are cheap, small devices (used in digital display watches, for example) that, with proper filters, can be made to emit most of their light in the infrared spectrum. The wavelengths are in what is known technically as the "near infrared," close to the range of visible light. Wavelengths in the rest of the infrared region are sensed as heat and would not be suitable for communications.

A central infrared station, installed in the ceiling of the room, would be the main control point for all the terminals. The station would poll each terminal in turn, asking, "Do you have any new data for me?" and the terminal would reply on a different frequency.

Terminals today are usually connected by copper coaxial cables to the host computer or to a central controller that communicates with the computer over phone lines if the computer is somewhere else.

"This means that every time you want to install a new terminal, you have to run a new cable, or even if you just want to move around the terminals you've got, the wiring has to be redone," says the manager of the IBM Research infrared group in Zurich, Hans Mueller.

The cost of stringing wire is expensive and is not expected to go down because of the labor involved in putting the wire into place.

Meanwhile, the tasks and relationships of terminals vis-a-vis the computer are evolving. Microprocessors provide many terminals today with a self-contained ability to process and to store data. The terminals do not need to remain in continuous contact with the main computer; they just need to "report in" occassionally, with relatively small loads of data.

"That's why we looked for ways terminals could communicate without wires and keep in line with low-cost consumer prices computer equipment of the future will have," said Mueller.

"In the same room or shop floor there is often a multitude of terminals clustered together," notes Dr. F. R. Gfeller, one of the IBM scientists at Zurich working on the infrared project.

"There is a need to place terminals flexibly at different positions within the same room to suit particular working conditions, to reconfigure existing terminal arrangements, or even to have mobile hand-held terminals," he says.

The installation of the central satellite station depends on the size and function of the work space. In an office area, where the floor-to-ceiling height would be only about 10 feet, diffuse,

nondirectional radiation seems the best choice. For this case, the satellite might look like an old-fashioned indirect lighting fixture hanging from the ceiling, with a shield below the surfaces of the room. The signals are thus reflected in every direction, filling the room and eliminating the need for line-of-sight between terminals and the satellite. This is important where the room may be divided by low partitions into several work stations and the terminals may be devices like typewriters and displays.

The other situation is the factory environment, where the room is much larger and the floor-to-ceiling distance greater. Here, line-of-sight is important because the terminals are more likely to be mobile, attached to carts, for example, or held in the hand of a foreman walking around. In this case, the satellite would be beaming directly to the floor.

☆☆☆ Announcements ☆☆☆

Inc. magazine will publish a special Office Technology Report in their February issue. The report will focus on how small to mid-size companies (sales of $1 to $25 million) can apply new information management and office automation technologies to help them become more efficient, effective, productive and competitive.

This special report will function as a survival kit, the magazine said, helping senior and middle management get through the maze of product and service offerings. The jargon-free articles will be written in the language of the non-technical executive.

Information Age's President, Robert Forest, and Vice President, Douglas DeCarlo are researching and writing the report. Mr. Forest was editor of Datamation from 1963 to 1974, and Mr. DeCarlo has worked in the information processing industry for the past ten years.

For more information, contact Inc. Magazine, 38 Commercial Wharf, Boston, MA 02110; (617) 227-4700.

The Computerized Office Equipment Expo-Midwest (formerly Chicagoland Business Services & Equipment Exposition), scheduled for April 30-May 2, 1980, will be held at the O'Hare Exposition Center in Rosemont, IL.

The Exposition will feature hundreds of the latest technological developments in computers, word processors, copiers/duplicators, telephone systems and other automated business equipment, said officials. In addition, a comprehensive conference program will provide in-depth information on computerization's effect on office procedures.

For complete details, contact Industrial & Scientific Conference Management, Inc., 222 West Adams Street, Chicago, IL 60606; (312) 263-4866.

The annual PACS Computer Games Festival sponsored by the Philadelphia Area Computer Society and LaSalle College Physics Department will be held March 15, 1980, from 10:00 a.m. to 6:00 p.m. in the LaSalle College Ballroom located at 20th & Olney, Philadelphia, PA 19141.

For further information contact Stephen A. Longo, Ph.D., Physics Department, LaSalle College, Philadelphia, PA 19141; (215) 951-1255.

The International Microcomputer Association, Inc., an organization representing microcomputer owners and users, is currently offering its services to members. Memberships are available to individuals and businesses alike.

IMA's services include substantial reductions in hardware and software costs through organized group purchasing arrangements; representation of its members to the microcomputer industry concerning resolution of problems between members and manufacturers, language and hardware standardization, improved manufacturer's warranties and development of new products; organization of local chapters which will bring together members in the same area for conferences, trade shows and establishment of local microcomputer networks; and competent, objective consultation on all phases of the microcomputer industry.

An official bi-monthly publication keeps members informed on IMA activities and current topics of interest, and will provide objective evaluations of both hardware and software microcomputer products.

IMA will also provide a directory of members (updated quarterly) so that IMA members may communicate on common problems and topics of mutual interest.

IMA's philosophy is essentially "strength in numbers." A large membership means more group purchase opportunities, a larger pool of experience to draw from in solving problems and a common front with which to deal with the industry, said IMA. Membership is available to individuals and businesses for $25 per year. For more information write IMA, Inc., 902 North Circle, Suite 205, Colorado Springs, CO 80909. *Circle No. 99.*

The Computer Forum, a new regional computer learning center in New Jersey, has established The Computer Forum Education Group for computer retailers. Membership is open to small business and personal computer retailers cooperating in the educational programs of The Computer Forum.

Participating retailers use The Computer Forum to serve their own customers. Students may be enrolled in the Forum's short courses, seminars and workshops directly by the dealer, who in turn receives a discount on the

tuition. Dealers may also conduct their own private classes at The Forum or train their own sales personnel, again at reduced costs compared to non-members.

The Computer Forum offers extensive educational programs in the fields of personal and small business computers. In addition to a professionally equipped multimedia seminar room, The Forum facilities include representative small computer systems in individual student carrels.

For more information call (201) 530-9103, or write The Computer Forum, 80 Broad St., Red Bank, NJ 07701.

A new educational consulting service, Logics One, helps teachers and administrators take advantage of powerful, low-cost microcomputer technology.

The new service will help school districts determine their instructional computer needs; locate, design and evaluate courseware and facilities; conduct training programs; prepare applications for grants and matching funds; and purchase equipment at the lowest available prices, said a service spokesperson. Similar service will also be provided to meet schools' administrative needs.

Educators who have pioneered the use of microcomputers in public school classrooms formed Logics One. For more information contact Logics One, Box 41, Utica, MI 48087.

Robotics Age magazine provides information about this rapidly growing field at many levels, according to the magazine. Understandable articles maintaining a high technical content present research results in robotics and artificial intelligence.

Robotics experimenters will find well-documented electromechanical circuit designs, microcomputer interfaces and programming techniques suitable for application to small systems with economy in mind. All articles have complete technical references. Selected abstracts of new research papers are also featured.

For those unfamiliar with the field, *Robotics Age* offers explanatory articles about basic techniques as well as the capabilities of the latest robot systems. New products capsules keep readers up to date on commercially available kits and robotics-related products.

The potential user of applied robotics will find articles describing current applications and research directions which could have a significant impact on productivity.

The quarterly publication is available at $8.50 for one year from *Robotics Age*., P.O. Box 801, La Canada, CA 91011, (213) 790-5823.

Hobby World Electronics announced the Hobbyworld Computer Club Alliance, offering discounts and specials to selected clubs in either group or individual purchases. Discounts are offered on the smallest components, memory ICs, software, printers, terminals and entire systems.

Details on membership can be obtained from Mr. Pat Olson, Hobby World Electronics, 19511 Business Center Drive, Northridge, CA 91324; (800) 423-5387, Ext. 25; in CA, (800) 382-3651, Ext. 25; local, (213) 886-9200, Ext. 25.

The Apple Educators' Newsletter contains information on clubs, other newsletters and publications, software and user letters. For more information contact David Miller, 9525 Lucerne St., Ventura, CA 93003; (805) 647-1063.

Engineering Computer Applications Newsletter provides information and guidance and explains how to obtain and effectively use microcomputers to increase productivity and profits.

Experiences of other engineers, computer capabilities and limitations, guidelines, new developments, costs and literature reviews are included.

The publisher, Engineering Computer Applications, Inc. of Colorado, is offering charter subscriptions for 12 monthly issues at a rate of $24 ($30 overseas airmail) to anyone mentioning this announcement. The premier issue is available free of charge. Contact Ken Johnson, ECAN, Engineering Computer Applications, Inc., 5 Denver Tech Center, P.O. Box 3109-M4X, Englewood, CO 80111; (303) 771-5307.

The Personal Computing Society, Inc., serves both veterans and potential personal computer users as a source of information on computer clubs and activities. For more information contact Abby Gelles, P.O. Box 147, Village Station, NY 10014.

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80 Software Critique, by Richard W. Clope, is a notebook-style publication consisting of 50 reviews of games and simulations available for the TRS-80. The critique judges each piece of software on fun/utility, originality, freedom from bugs, instructions/documentation, technique and dollar value. In addition to the ratings (the publisher's opinion), information for playing the game, or what the program does, is provided. The author also offers bug corrections for several programs.

Subscription price is $28 for four issues. For more information contact RWC Microcomputing Services, P.O. Box 134, Waukegan, IL 60085.

The Apple Cart is a new special interest group formed within American Mensa. The group, primarily for owners of Apple Computers, publishes a newsletter and operates a software exchange for its members. Annual dues are $4 for Mensa members and $6 for others. For more information send a self-addressed, stamped envelope to: C. Brandon Gresham, Jr., National Coordinator, The Apple Cart, 23 Van Buren Street, Dayton, OH 45402.

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CIRCLE 8

U.S. a One-Product Country?

BY BILL PARKS

The United States today manufactures and exports more computers and computer-related products than does any other country in the world. Many years ago Switzerland was the undisputed capital of clock and watchmaking. Swiss time-pieces were exported throughout the globe. America now seems headed for a similar reputation in computer technology — based on figures released each year. The figures reveal an ever expanding computer-based manufacturing industry.

American computers, like the older Swiss time-pieces, are developing an unequaled reputation for reliability, precision, and accuracy. We excel every other country in computers, on this planet. At the rate America's computer industries are growing, it seems plausible to state that within 50 years there might be only two products worth listing in a catalog of American exports: computers and — of course — wheat from the great plains. One will be the basic food supplement for the mind, and the other will provide essential nutrients for the body. A very nice pair of exports! The world, as a whole, is gradually coming to depend on our computer power and we've got it!

One American company alone, IBM, sells more computers in a year than does all of Western Europe plus all of the Communist countries combined. Another rapidly developing American computer company, NCR, is specializing in foreign sales. It has become one of the foremost leaders in the field of exports. Burroughs, Honeywell, Control Data, and many other American-based computer companies are rapidly expanding their sales offices in nearly every country — big and small. Even the developing nations of Africa are interested in American know-how and are buying our computer technology. The Communists need our computer technology. Russia, Red China, Poland — they all want to import American computers!

Of course computers can't run themselves. The computer requires programs to be operable. Therefore, the related industry of software publishing is also growing by leaps and bounds. One knowledgeable forecasting firm has already predicted that more than half the programmers in the United States will be employed by big software houses in the near future. So we must keep in mind when we predict an increase in the sales and export of hardware — we must also expect a corresponding increase in the sale and export of software. You can't be successful in one without the other. Imagine, selling software on tapes and disks and exporting programs in BASIC, FORTRAN, COBOL, PASCAL, and other computer languages — made in America.

So the "Made in America" label will not only appear on computer hardware, but it will also be imbedded in computer software. Meanwhile, as a country we will continue to make less and less of other types of products. Fabrics, leather goods, steel, shoes, etc., etc., etc. will be abandoned on the whole as products that were once profusely produced in America. In the future we'll be too busy making and maintaining the world's computers. "The United States of IBM" is not a bad label to have for this country. The computer industry is a clean industry. It involves highly technical people. The work force in America would gradually shift away from "heavy machinery" factories to the "knowledge-type" industries. The employment rate in this country would grow as would the lot of the working class. They will be better educated and higher paid — characteristics common today in the computer field. The work would be intellectual, challenging, and very satisfying. The computer industry not only will need engineers to produce the hardware or programmers to write the software, but it will also generate a host of other job categories — technicians, word-processors, data-base managers, terminal operators, systems analysts, etc., etc., etc.

This describes an evolution, perhaps, more appropriate a revolution in job developments. Perhaps the largest union of tomorrow will be called "The United Programmers of America".

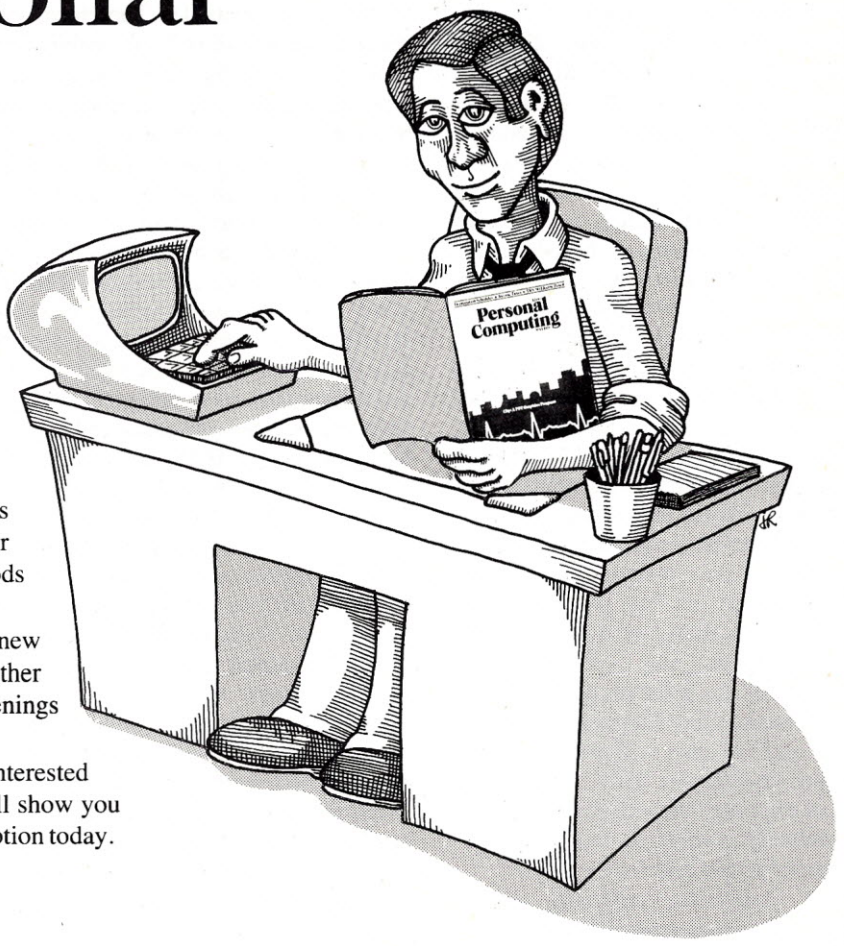
What can we Americans do today to foster this coming change in our economic structure? For one thing, we should start immediately in our schools. We must introduce computer "literacy" in the elementary grades — "reading, writing, arithmetic, and computing". Gradually our children will become quite knowledgeable and as they enter high school, they will be able to select a number of computer based courses for study. Computer-assisted intruction should be introduced at all levels of education. All curriculums can be infused with computer related applications. In fact, the study of computer science should become so pervasive that it will become transparent — that is, taken for granted as an important subject that everyone will understand — like reading and basic arithmetic.

Policy-makers and planners in all walks of life should become active in seeking decisions for future involvements of computer technology in their respective fields. The governments are already traditionally heavy computer users. This, of course, fosters a healthy computer economy. With the growing emergence of small business computing and the developing home-computing market, computer companies should actively support retaining of the general population. Seminars can be a common experience even for the home user. We all are familiar with how utility companies in the past would present public shows and demonstrations of their energy-using appliances increasing both understanding and sales. Computer companies can sponsor education programs in a similar way both for their own advantage and for the benefit of the people.

Lastly, the computers of tomorrow depend on the research being done in the laboratories today. Corporations — large and small — foundations, governmental agencies and other types of agencies should contribute time and money in a solid on-going research and development program. If our research slips, other countries may not necessarily sit idly by. If we want to remain number one we're going to have to work hard at it!

Bill Parks is Assistant Professor in Mathematics and Computer Sciences at Fredonia State University College, Fredonia, NY 14063.

For the "Plug-In" Professional



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TV Registrations & Service Contract Sales

BY CLINT HENTZ

If you own or manage a television store which provides both sales and service, you're no doubt aware of the H.E.W. registration requirement. And, if you've chosen the option allowing you to register each television sale with the manufacturer (as opposed to keeping all the sales records available for use in a possible manufacturers recall or factory alteration), the listed demonstration program may help you get some "extra mileage" out of your computer.

Since our store sells about 250 televisions a month, we elected to register all sales with the manufacturer. So I wrote a registration program for my 48K, Level 2 TRS-80 (with cassette drive and Centronics tractor feed line printer) — and then got extra mileage by using the computer for service contract solicitations as well.

We input to the computer the vital data contained on each sales check, such as name, address, make of television, model, serial number and date purchased. This information is also required on the H.E.W. registration form. We then run the program using the information input from the sales-check. Up to this point, no time has been saved, as we would have had to make out the registration forms regardless of the procedure used.

But now comes the real time-saving bonus. Thirty days before the manufacturer's limited warranty expires, we run the program again to print out a service contract solicitation for each customer. Our only time expended was in putting the service contract solicitation forms into the printer. Type RUN, select "Service Contract Print Out" and ENTER. Then, the computer and printer work together unattended. More time is saved when the customers Service Contract expires and another solicitation is made.

So it is easy to see that if you are in the business of selling televisions and service contracts, a microcomputer can be a real help. If you are not in the business, perhaps the program will give you an idea for your computer in your own small business.

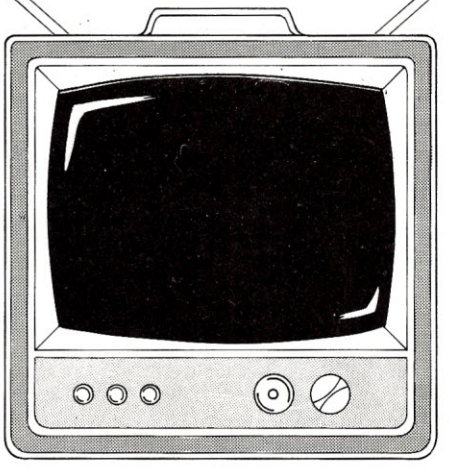


Illustration by Sue Genser

Operational procedure

1. Write a program based on the demonstration program allowing extra space for the printouts to conform to registration and contract form.

2. Try out program on blank paper; make dummy runs to be sure your program and procedures are compatible.

3. Order the forms. A local printer made our registration forms. The service contract forms, developed into a very efficient multi-part form including a return envelope, were made by a nationally known printing company. However, you may want to use a single part form printed by a quick--print shop.

4. If you are starting the program during the first month of the year, make 12 tapes, each containing a copy of the program. On the cassette label, mark each tape with one of the twelve months and the year (January 1980, February 1980), then select the current month's tape. In this example we will use the January 1980 tape and input the sales check information for each customer purchasing a TV during January. Use one line for each customer's data.

5. During the first week in February, insert the registration forms into the printer and RUN the January program and data tape. Mark a date, around the 20th of March, on the calendar to jog your memory to print out the service contract solicitations for televisions sold in January. After you've used the system for several months, you can skip the calendar routine as you will remember to look for the tape to be run.

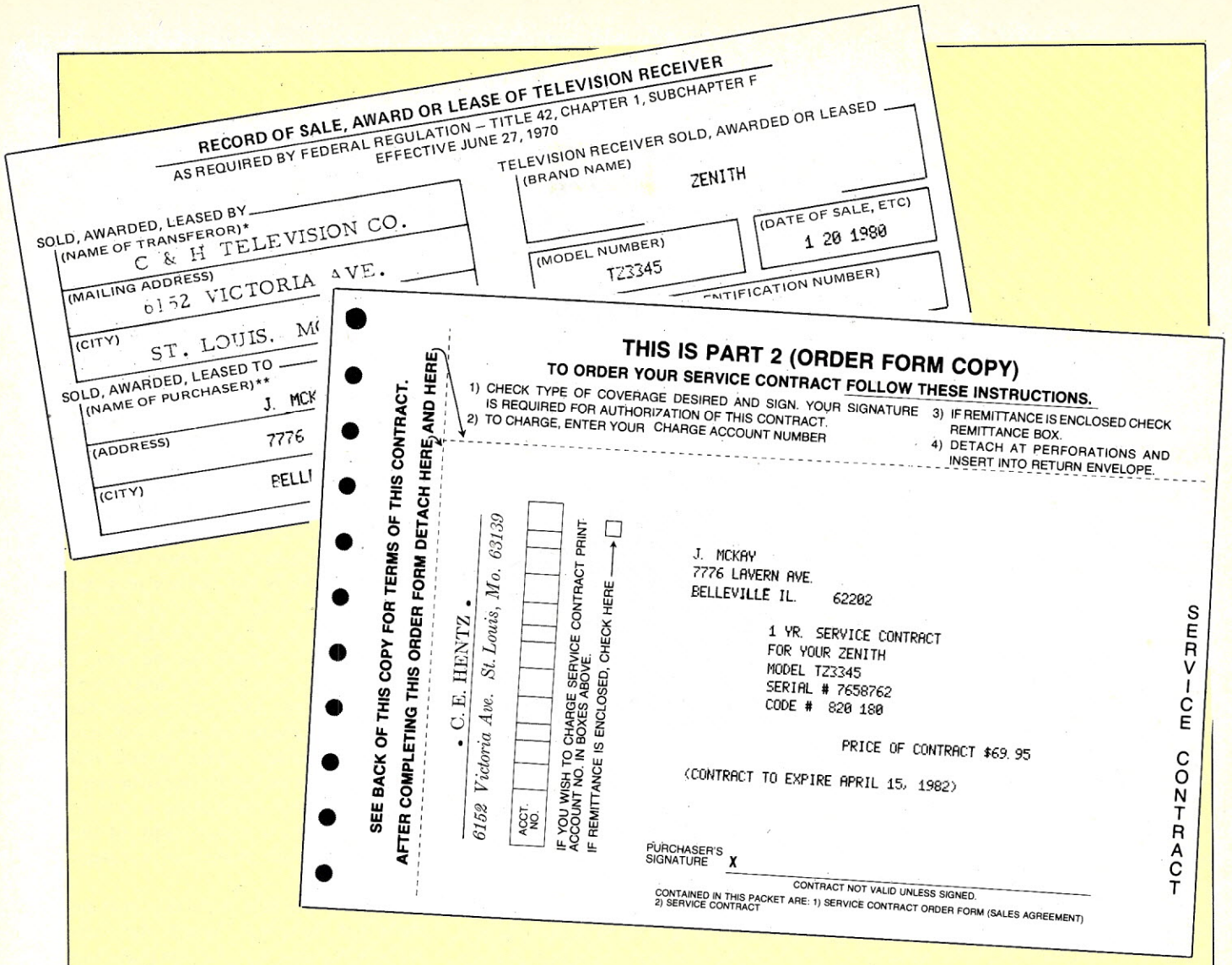
6. Customers purchasing a service contract return a signed copy of the form along with money or a charge number.

7. Since the date is on the form the customer returned, insert the corresponding tape into the computer and use the code number to look up the customer's data line. Then change the date, H$, to next year. In our example the date would become 1981.

At this point, a given month's tape contains all customers who purchased a TV during that period and an indication of which customers purchased a one-year service contract. Since we sell 250 TVs and 135 service contracts each month, you can see that the computer saves us a lot of retyping. We just type up the H.E.W. registrations and get a free ride on all the service contract solicitations.

The demo program effectively handles the H.E.W. registrations and the first-year solicitation of service contracts. There are, of course, other ways to write the program using single or dual cassettes with PRINT #-1 and INPUT #-2 statements, or combining more months on one tape.

I wrote the program for 12 monthly tapes because tapes are inexpensive: I pay 33¢ for a 60-minute tape at a local discount store. Also, using one tape per month makes it quick and easy to load the program-data tape I want.


RECORD OF SALE, AWARD OR LEASE OF TELEVISION RECEIVER
AS REQUIRED BY FEDERAL REGULATION – TITLE 42, CHAPTER 1, SUBCHAPTER F
EFFECTIVE JUNE 27, 1970
SOLD, AWARDED, LEASED BY (NAME OF TRANSFEROR)* C & H TELEVISION CO.
(MAILING ADDRESS) 6152 VICTORIA AVE.
(CITY) ST. LOUIS. MO
SOLD, AWARDED, LEASED TO (NAME OF PURCHASER)** J. MCK
(ADDRESS) 7776
(CITY) BELL
TELEVISION RECEIVER SOLD, AWARDED OR LEASED
(BRAND NAME) ZENITH
(MODEL NUMBER) TZ3345
(DATE OF SALE, ETC) 1 20 1980
ENTIFICATION NUMBER)
THIS IS PART 2 (ORDER FORM COPY)
TO ORDER YOUR SERVICE CONTRACT FOLLOW THESE INSTRUCTIONS.
1) CHECK TYPE OF COVERAGE DESIRED AND SIGN. YOUR SIGNATURE IS REQUIRED FOR AUTHORIZATION OF THIS CONTRACT.
2) TO CHARGE, ENTER YOUR CHARGE ACCOUNT NUMBER
3) IF REMITTANCE IS ENCLOSED CHECK REMITTANCE BOX.
4) DETACH AT PERFORATIONS AND INSERT INTO RETURN ENVELOPE.
SEE BACK OF THIS COPY FOR TERMS OF THIS CONTRACT.
AFTER COMPLETING THIS ORDER FORM DETACH HERE AND HERE
• C.E. HENTZ •
6152 Victoria Ave. St. Louis, Mo. 63139
ACCT. NO.
IF YOU WISH TO CHARGE SERVICE CONTRACT PRINT ACCOUNT NO. IN BOXES ABOVE.
IF REMITTANCE IS ENCLOSED, CHECK HERE
J. MCKAY
7776 LAVERN AVE.
BELLEVILLE IL. 62202
1 YR. SERVICE CONTRACT
FOR YOUR ZENITH
MODEL TZ3345
SERIAL # 7658762
CODE # 820 180
PRICE OF CONTRACT $69.95
(CONTRACT TO EXPIRE APRIL 15, 1982)
PURCHASER'S SIGNATURE X
CONTRACT NOT VALID UNLESS SIGNED.
CONTAINED IN THIS PACKET ARE: 1) SERVICE CONTRACT ORDER FORM (SALES AGREEMENT) 2) SERVICE CONTRACT
SERVICE CONTRACT

Program Notes

90 The printout obtained from this selection checks omissions of data in data lines.

190 Some computers, such as the IBM 5100, will not accept this type of statement. If your computer will not accept it, break it down into four lines, such as IF S1 equals 1 GOTO 200. Then the next line IF S1 equals 2 GOTO 270, and so forth.

200 LPRINT" xxxxxx" sends info to printer. IBM 5100 requires a statement PRINT FLP"xxxxx"

210 LPRINT" "leaves a blank line on the printout. IBM 5100 requires PRINT FLIP"xxxxxx"

230 Used with PRINT USING. % % indicates location of a string variable. IBM 5100 allows ### for numbers and strings.

280 & 290 Are counters to provide code number on service contract. Is actually the line number where the data is located.

310 Saves a lot of entry time. It's a lot quicker to type an S than to type "St. Louis, MO." Applies to 320, 330, 340, 350. Prevents errors in spelling too!

380 Some companies require two copies of the H.E.W. registration. This demonstrates the production of two copies for RCA. Statement, as is, will not work on IBM 5100; it must be a two-line statement.

410 Multi-line statement leaves three blank lines in print out. IBM 5100 will not accept multi-line statements. It requires three separate lines of PRINT FLP.

550 RIGHT(H$,4) takes last four characters of H$. Some computers, including the IBM 5100, will not accept this type of statement.

660 Prints code number along with 180, which is January 1980. Change the date to correspond to your time table.

680 Your price goes here. You could offer more than one type of service, such as In-Home or Carry-In. Just add another line stating the type of service and the price, with a place for the customer to indicate choice.

700 Change the date to conform to your time table.

800 One customer to a line or the code number system will not work. We find the code system helpful as we have about 250 customers to a tape.

Variable Table

A$	Customer's name	B$	Address
C$	City & State	D$	Zip Code
E$	Make of TV	F$	Model
G$	Serial Number	H$	Purchase Date
X, M	Counters	Z1	Print Using

Program Listing

```
10 REM          SERVICE CONTRACTS, TELEVISIONS & H.E.W
20 REM
30 REM                        BY
40 REM                  C L I N T    H E N T Z
50 REM                   ST. LOUIS, MISSOURI
60 REM
70 PRINT"                 S E L E C T I O N"
80 PRINT
90 PRINT"       1. PRINT OUT CHECK OF DATA ENTRY"
100 PRINT
110 PRINT"       2. PRINT OUT H.E.W. REGISTRATION FORMS"
120 PRINT
130 PRINT"       3. PRINT OUT SERVICE CONTRACT SOLICITATIONS"
140 PRINT
150 PRINT"       4. PRINT OUT OF CUSTOMERS HAVING PURCHASED CONTRACT"
160 PRINT
170 PRINT"           MAKE SELECTION THEN PRESS ENTER"
180 INPUT S1
190 ON S1 GOTO 200  ,270  ,270  ,270
200 LPRINT"         CHECK ON DATA ENTRY"
210 LPRINT"  "
220 READ A$,B$,C$,D$,E$,F$,G$,H$
230 Z1$="%          % %                  %%              % %    % %       % %         % %
240 LPRINT USING Z1$;A$,B$,C$,D$,E$,F$,G$,H$
250 IF A$="9999" GOTO 730
260  GOTO 220
270 READ A$,B$,C$,D$,E$,F$,G$,H$
280 X=X+10
290 M=790+X
300 IF A$="9999" GOTO 730
310 IF C$="S" THEN C$="ST. LOUIS MO.
320 IF C$="B" THEN C$="BELLEVILLE IL."
330 IF C$="E" THEN C$="E. ST. LOUIS IL."
340 IF E$="MAG" THEN E$="MAGNAVOX"
350 IF E$="Z" THEN E$="ZENITH"
360 IF S1=3 THEN 570
370 IF S1=4 THEN 550
380 IF E$="RCA" THEN R=2 ELSE R=1
390 FOR I= 1 TO R
400 LPRINT TAB(63)E$
410 LPRINT"  ":LPRINT"  ":LPRINT"  "
420 LPRINT TAB(55) F$,,H$
430 LPRINT"  ":LPRINT"  "
440 LPRINT TAB(5)A$;
450 LPRINT TAB(55)G$
460 LPRINT"  "
470 LPRINT TAB(5)B$
480 LPRINT"  "
490 LPRINT TAB(5)C$,D$
500 LPRINT"  ":LPRINT"  ":LPRINT"  ":LPRINT"  "
510 LPRINT"  ":LPRINT"  ":LPRINT"  "
520 LPRINT"  ":LPRINT"  "
530 NEXT I
540 GOTO 270
550 J$=RIGHT$(H$,4)
560 IF J$="1981" THEN 570  ELSE 270
570 LPRINT TAB(5)A$
580 LPRINT TAB(5)B$
590 Z1$="     %              % %    %"
600 LPRINT USING Z1$;C$,D$
610 LPRINT "  "
620 LPRINT TAB(15)"1 YR.  SERVICE CONTRACT"
630 LPRINT TAB(15)"FOR YOUR ";E$
640 LPRINT TAB(15)"MODEL ";F$
650 LPRINT TAB(15)"SERIAL # ";G$
660 LPRINT TAB(15)"CODE # ";M;"180"
670 LPRINT "  "
680 LPRINT TAB(25)"PRICE OF CONTRACT $69.95"
690 LPRINT"  "
700 LPRINT TAB(5)"(CONTRACT TO EXPIRE APRIL 15, 1981)"
710 LPRINT "  ":LPRINT"  ":LPRINT"  ":LPRINT"  "
720 GOTO 270
730 END
800 DATA L.  JORDAN,  BOX 234 RT1, S, 63055, RCA, TS456, 2436475, 1 20 1980
810 DATA C.  SWEENEY, 6548 REBER PL. , S, 63133, MAG, GHW890, 98712315, 1 18 1980
820 DATA J.  MCKAY, 7776 LAVERN AVE. , B, 62202, Z, TZ3345, 7658762, 1 20 1980
830 DATA J.  SMITH, 2367 29TH ST. , E, 62221, Z, TR56, 769821K, 1 18 1980
840 DATA H.  SANDERS, 8990 COCHELLA DR. , S, 63125, GE, YTC4449, 23416, 1 22 1980
850 DATA 9999, 9999, 9999, 9999, 9999, 9999, 9999, 9999
```

Sample Run

```
PRINT OUT OF DATA ENTRY

        CHECK ON DATA ENTRY

L. JORDAN     BOX 234 RT1          S      63055  RCA      TS456       2436475      1 20 1980
C. SWEENEY    6548 REBER PL.       S      63133  MAG      GHW890      98712315     1 18 1980
J. MCKAY      7776 LAVERN AVE.     B      62202  Z        TZ3345      7658762      1 20 1980
J. SMITH      2367 29TH ST.        E      62221  Z        TR56        769821K      1 18 1980
H. SANDERS    8990 COCHELLA DR.    S      63125  GE       YTC4449     23416        1 22 1980
9999          9999                 9999   9999   9999     9999        9999
```

How to write for Personal Computing

You've written the programs we want to publish. You – the *Personal Computing* readers – are using your computers in businesses, homes, offices and schools. Other readers, just as software-hungry as you, are eager to try out your programs, your applications and your techniques. So why not share what you've done by submitting an article to *PC?*

It's easier than you might think. Remember: we're more interested in practical programs and useful applications than in fancy prose. And our editorial staff stands ready to help with any problems you encounter in writing your article; just give us a call at (617) 232-5470.

Here are some handy guidelines to help you get started.

First, decide what kind of article you want to write. Do you have a *business program* that will help an executive, salesman, doctor, lawyer or shopkeeper function more efficiently? Think about how businesses can benefit from microcomputers – not only in the obvious areas of inventory, accounting and payroll, but in all departments and levels right up to the president's desk. Financial and marketing analysis, time management, planning, material handling, product design and cost accounting are areas ripe for creative programming.

How do you use your computer for *home and personal applications* in your living room, kitchen, study or den? Again, think beyond the obvious areas of checkbook balancing and budgeting (though these areas are far from exhausted) to other applications. Hobbies, home management, household inventory, gardening and landscaping, personal income and expense analysis, personal mailing lists and word processing are just a few ideas to spark your imagination.

What *education programs* have you written for children, adults, professionals, businessmen and teachers? Computers can not only teach children basic subjects such as spelling, math, geography, economics, civics, grammar, literature and science, but can help adults review or sharpen skills in these areas as well. How else can computers function in or out of the classroom to aid learning? To help teachers and administrators?

Are you proficient in some programming technique or special computer area you could explain in a *tutorial article*? How do you save time, money, computer memory or frustration when programming or using your computer? Others can benefit from the same techniques you use.

Computer games, history, humor and *fiction* are other areas rich in article and story ideas.

Your second step is to write the text of the article. Remember, readers aren't familiar with your program. So explain in detail what the program does and how it does it. Include here the overall structure of your program as well as any special algorithms or routines you've used. Give suggestions for modifying or expanding the program for other applications, other businesses or other situations.

Third, prepare your supporting documentation. Include at least a program listing and one or two sample runs, and add program notes to explain any special commands used or other special features of your program. Use charts, diagrams, figures and photos if they help explain your program and its use.

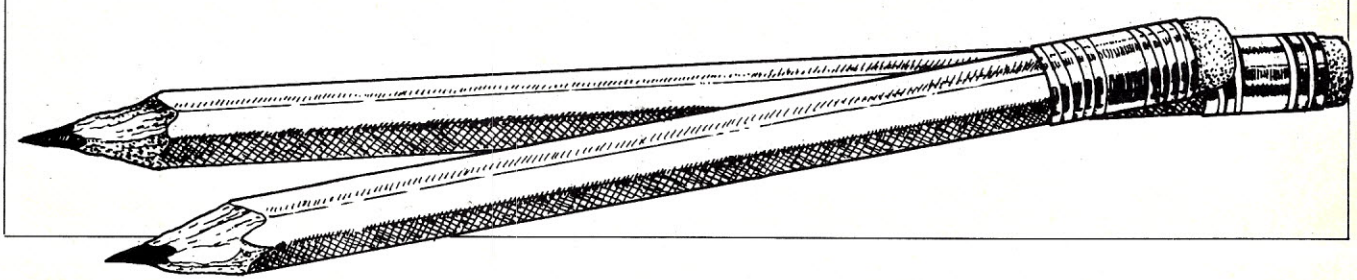
Finally, mail your manuscript. Address it to: Don Wood, Managing Editor, Personal Computing Magazine, 1050 Commonwealth Ave., Boston, MA 02215.

A few suggestions: All submissions should be original, typed (*not* all CAPS), double-spaced and neat. Please include your name and address on the first page of the article and enclose a self-addressed, stamped envelope for return of material.

Since we photograph program listings and sample runs exactly as you send them to us for publication in the magazine, please be sure you use a fresh ribbon for computer printouts. If you don't have a printer, you can type your listings single spaced; but again, be sure you use a new ribbon. (If your program relies heavily on graphics, you can photograph sample runs from your CRT. But take care to avoid distortion due to the curve of the screen.)

Feel free to call us if you have any questions or want to discuss specific ideas. We can give you feedback and suggest appropriate slants and approaches.

We're always looking for fresh, original ideas. While these guidelines will help you in preparing material for *Personal Computing*, don't assume we don't want your idea just because it's not mentioned here. Let us and our readers know what *you're* doing with your computer.



Al's Easy Data Handling Routine

BY DALE R. BASYE

On Wednesday, my day off from the rigors of the office, I usually tackle outside the house chores. However, today it chose to rain so my activities were curtailed for the week. Rather than let the day pass with nothing accomplished I decided to go over to Al's Computer Store and jaw awhile.

When I arrived, the showroom floor was quiet except for the whistling of an unfamiliar tune coming from the back room. It sounded like Al had licked another of the bugs that invariably find their way into even the most carefully planned programs. I strolled back to see what it was all about.

"Hi, Johnnie. I was kinda hoping I might see you today," Al said as I entered. "You remember a while back when I was having such a time trying to get my tape files to load into Sol's memory so I could edit 'em?"

"Yes," I said as I tried to recall what Al was referring to.

"Processor Tech's Extended BASIC has some mighty nice features about it; but one of it's shortcomings is the inability to read character strings into a matrix from tape files."

"Amen" I said. "There has been a time or two that I wanted to do just that and ended up using data statements instead. It got to be a nuisance having to change the data every day or so."

I could see that gleam in his eye as he was about to reveal how he had accomplished what I had given up on.

"This program I'm working on," he continued, "consists mainly of customers names and the type of computer gear they own. Frequently I have to update it for my mailing list. A Sol owner shouldn't get an advertisement for a TRS-80 peripheral device or vice versa. They do get upset sometimes."

"Yeah, I suppose they would," I agreed.

"The other day I ran across an article in *Personal Computing* that mentioned the use of a single dimensioned string matrix. I didn't give it much thought until this morning. The idea seemed to have been created for just this type of situation."

"What is a single dimensioned string matrix?" I asked. "It doesn't sound like it would be of much use if it only stores one string."

"You're right there, Johnnie. But remember that PT's BASIC allows the length of a string variable to be as long as there is available memory to contain it. If a string of, say 10,000 characters, was broken down into smaller segments within the string then you could easily store several data statements in a single string."

"I'm not quite sure I understand just what you're driving at," I said, wondering if my trusted friend had finally dropped a bit.

"Well, let me try to explain it another way," offered Al. "Let's say for example that we had a data statement consisting of a customer's name and a reference to some peripheral device, say a disk drive. If we allocate 30 characters to the customer's name and 20 characters for the type of disk drive, then we could construct a string of 50 characters long."

"I think I see what you're up to. By putting several strings consecutively in a larger string we wouldn't need any data statements. Right?"

"That's it in a nutshell, Johnnie. Now if we apply that to a long string, say DIM B$(10000), then we can have 200 segments each 50 characters long contained in the B$ string. Using a FOR X=1 TO LEN(B$) STEP 50 loop, we can extract any single 50 character segment at will."

"You lost me there, Al. How are we gonna get the information we want out without destroying the data in the string?"

"Hand me that sheet of paper over there and I'll show you what I mean," Al said. He scratched down this program:

```
10   FOR X=1 TO LEN(B$) STEP 50
20       I$=B$(X,X+49)
30   NEXT X
```

"OK, here we are," said Al. "Line 10 sets up the FOR/NEXT loop parameters to scan each segment of the string. Line 20 loads variable I$ with each segment in succeeding order. Now we can do with I$ anything we want to."

"It sure looks simple after you describe it like that. But what happens when we try to update the data in the B$ string?

"Not so fast now, Johnnie. Let's print the data out to the monitor first."

"OK," I said somewhat impatiently.

"Suppose we insert a subroutine something like this," Al said:

```
100 PRINT I$(1,30);TAB(40);I$(31,50)
```

"After we've printed out the desired segment we can see whether it needs updating. If it does, then we use a routine something like this."

```
10   FOR X=1 TO LEN(B$) STEP 50
20       I$=B$(X,X+49)
30       GOSUB 100
40   NEXT X
50   STOP
100  PRINT I$(1,30);TAB(40);I$(31,50)
```

```
110  INPUT"CHANGE DATA
     (Y/N)?",A$
120  IF A$=N THEN RETURN
130  IF A$< >Y THEN GOTO 110
140  INPUT"NEW DATA",D$
150  I$(31,50)=D$:B$(X,X+49)=I$
160  RETURN
```

"As you can see, line 20 loads I$ with the desired segment of the B$ string. At line 100, we print out the data to the monitor so we can see just what we have. Line 110 asks if we want to make a change. Lines 120 and 130 process our answer and line 140 asks us for the new data. Line 150 inserts the new data first into the desired segment of I$ and then I$ into the B$ string so it contains the updated information we wish to store."

"Pretty tricky, Al. That sure does make it easy to update a string of data statements without using the EDIT commands in BASIC. There is one thing that puzzles me, though."

"What's that, Johnnie?"

"After we have all of our statements in the B$ string, how can we save it on tape?" I asked.

"That's a good question. As you know, PT's BASIC won't dump a string of over 120 characters to tape using their FILE capabilities. So we need to break it down into smaller segments. Hand me that paper again."

As Al wrote down his routine, I thought of some uses I had for such a program as this. He slid the paper back to me with this program appended.

```
10  FILE#1;"MAIL",2
20  FOR X=1 TO LEN(B$) STEP 50
30      I$=B$(X,X+49)
40      PRINT#1;I$
50  NEXT X
60  CLOSE#1
70  END
```

"This program loads the I$ variable with 50 character segments of the B$ string and saves each segment consecutively in a file called 'Mail'," Al said. "When you want to load data back into the B$ string from the tape, you can use this program to do it with."

```
10  FILE#1; "MAIL",1
20  READ#1;I$: GOTO 50
30  LET B$=B$+I$
40  GOTO 20
50  CLOSE#1
60  END
```

"As this program is executed," Al continued, "line 20 reads each variable from the tape and stores it in the I$ variable. Line 30 adds the I$ string to the existing contents of the B$ variable until and EOF (End of File) code is read from the tape in line 20. The program will then jump out of the loop to line 50, where the 'Mail' file will be closed from further access."

"By golly, Al, I think that pretty well explains what a single dimensioned string matrix is. I'm gonna sit down with ole Sol tonight and convert my data programs over using this format. It'll sure make 'em a lot easier to run." □

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CIRCLE 12

Generating Price Lists

BY IRA S. GERSON

Have you ever had the responsibility for generating a price list for at least three products, each having as many as four quantity price breaks (1-10 units, 11-20 units, etc.)? Those of you with even more then three products, each having several price breaks due to economies of scale, have my sympathies. I would like to share with you my solution to generating such lists/schedules.

There are two approaches (marketing and manufacturing) to developing a logical and uniform price list for multiple products with various quantity price breaks. To solve either of them quickly, I wrote two programs for the TRS-80 in Level I BASIC using only 4K of RAM. The program should be easily converted to other BASIC software systems.

With a marketing approach, you are given the conditions of the marketplace, such as list price, number of distribution steps, maximum acceptable dealer discounts off list (Dealer Gross Margin), and the minimum gross margin you as a producer wish to achieve with the product(s) in question.

Once this is done, your manufacturing cost is determined by the listed parameters and you must be able to achieve this

Program Listing

```
 2 REM * THIS PROGRAM CALCULATES DEALER NET,
   DEALER GM (% OFF LIST),
   COST, & MANUFACTURER'S GM FOR
   ONE STEP DISTRIBUTION *
10 P. "ENTER REQUEST"
12 P. "---1-MARKETING APPROACH"
14 P. "---2-MANUFACTURING COST APPROACH"
16 P. "---3-END OF RUN"
18 INPUT "SELECTION"; R
19 CLS
20 ON R GOTO 22, 82, 142
22 P. "MARKETING APPROACH"
24 INPUT "LIST PRICE"; P
26 INPUT "MAXIMUM (%) OFF LIST"; B
28 INPUT "MINIMUM FACTORY GM(%)"; H
30 INPUT "NUMBER OF QUANTITY PRICE BREAKS";Q
32 INPUT "DEALER DISCOUNTS PER BREAK (%)";Y
33 CLS
34 FOR N = 1 TO 63
36 P. TAB(N);"-";
38 NEXT N
40 P. TAB(20);"LIST";TAB(37);"DEALER";
   TAB(46);"%";TAB(52);"MFG"
42 P. TAB(3);"MODEL--DESCRIPT";TAB(20);
   "PRICE";TAB(29);"QUANT";
   TAB(39);"NET";
44 P. TAB(46);"OFF";TAB(51);"COST";
   TAB(58);"% GM"
46 P. TAB(22);"$";TAB(29);"UNITS";TAB(39);
   "$";TAB(45);"LIST";
47 P. TAB(53);"$"
48 FOR N = 1 TO 63
50 P. TAB(N);"-";
52 NEXT N
54 P. TAB(49); "OFFICE USE"
56 FOR N = 44 TO 63
58 P. TAB(N);"-";
60 NEXT N
62 FOR A=B-(Y*(Q-1)) TO B STEP Y
64 D=P*(1-A/100)
65 D=D+.005:D=INT(D*100)/100
66 C=P*(1-B/100)*(1-H/100)
67 C=C+.005:C=INT(C*100)/100
68 G=(D-C)/D*100
70 G=G+.5:G=INT(G)
72 P. TAB(3);"1234A--WIDGET";TAB(20);P;
   TAB(37);D;TAB(46);A;TAB(51);
   C;TAB(58);G
74 NEXT A
76 FOR N = 1 TO 63
78 P. TAB(N);"-";
79 NEXT N
80 INPUT"PRESS ENTER FOR MENU";A$:CLS
81 GOTO 10
82 P. "MANUFACTURING APPROACH"
84 INPUT "COST"; C
86 INPUT "MAX % OFF LIST"; B
88 INPUT "MIN MFG GM %"; H
90 INPUT "NUMBER OF QUANTITY PRICE BREAKS";Q
92 INPUT "DEALER DISCOUNTS (%) PER BREAK";Y
93 CLS
94 FOR N = 1 TO 63
96 P. TAB(N);"-";
98 NEXT N
100 P. TAB(20);"LIST";TAB(37);"DEALER";
    TAB(46);"%";TAB(52);"MFG"
102 P. TAB(3);"MODEL--DESCRIPT";
    TAB(20);"PRICE";TAB(29);"QUANT";
    TAB(39);"NET";
104 P. TAB(46);"OFF";TAB(51);"COST";
    TAB(58);"% GM"
106 P. TAB(22);"$";TAB(29);"UNITS";
    TAB(39);"$";TAB(45);"LIST";
107 P. TAB(53);"$"
108 FOR N = 1 TO 63
110 P. TAB(N);"-";
112 NEXT N
114 P. TAB(49);"OFFICE USE"
116 FOR N=44 TO 63
118 P. TAB(N);"-";
120 NEXT N
122 FOR A=B-(Y*(Q-1)) TO B STEP Y
124 D=C*(1-A/100)/((1-B/100)*(1-H/100))
125 D=D+.005:D=INT(D*100)/100
126 P=C/((1-B/100)*(1-H/100))
127 P=P+.005:P=INT(P*100)/100
128 G=(D-C)/D*100
130 G=G+.5:G=INT(G)
132 P. TAB(3);"1234A--WIDGET";TAB(20);P;
    TAB(37);D;TAB(46);A;
    TAB(51);C;TAB(58);G
134 NEXT A
136 FOR N = 1 TO 63
138 P. TAB(N);"-";
139 NEXT N
140 INPUT"PRESS ENTER FOR MENU";A$: CLS
141 GOTO 10
142 END
```

cost figure if you expect to maintain the given discounts, factory gross margin and list price.

Because a computer can run through so many iterations quickly, you can play with some of the input variables to refine a total pricing structure to your particular needs. Obviously you can adjust one or more quantity price breaks to suit a special objective after you have determined the input variables for the general case.

In the manufacturing approach, you are given the cost of a product and wish to determine what type of market pricing structure may prove profitable.

Each approach can be substituted for the other and my program is written so you can select the method you prefer.

Sample Run

Let's try an example of generating a price list using the program. Assume you are a manufacturer (or wholesaler) who wishes to supply a product which could command a list price of $200 per unit in the marketplace. There are four price breaks (1 to 11 units, 12 to 24 units, 25 to 49 units and 50-plus units). The distribution discounts can go as high as 40% off list for the largest quantity bought by your retailer (dealer). If you assume a GM of 30% as your minimum objective for this product along with a value you wish to increase each price break (2%), the program will generate a list as shown. □

Sample Run

*In the Sample Run on the right, the numbers under the heading "Quant Breaks" can be added by you manually after running the program. This allows you greater flexibility in determining at which points you wish to give quantity breaks.

MODEL--DESCRIPT	LIST PRICE $	QUANT UNITS	DEALER NET $	% OFF LIST	MFG COST $	% GM
				OFFICE USE		
1234A--WIDGET	200	*1-11**	132	34	84	36
1234A--WIDGET	200	*12-24*	128	36	84	34
1234A--WIDGET	200	*25-49*	124	38	84	32
1234A--WIDGET	200	*50+*	120	40	84	30

PRESS ENTER FOR MENU?-

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VT132 CRT DECscope	2,295	220	122	83
DT80/1 DATAMEDIA CRT	1,895	182	101	68
TI745 Portable Terminal	1,595	153	85	57
TI765 Bubble Memory Terminal	2,795	268	149	101
TI810 RO Printer	1,895	182	101	68
TI820 KSR Printer	2,195	210	117	79
TI825 KSR Printer	1,695	162	90	61
ADM3A CRT Terminal	875	84	47	32
QUME Letter Quality KSR	3,195	306	170	115
QUME Letter Quality RO	2,795	268	149	101
HAZELTINE 1410 CRT	875	84	47	32
HAZELTINE 1500 CRT	1,195	115	64	43
HAZELTINE 1552 CRT	1,295	124	69	47
DataProducts 2230 Printer	7,900	757	421	284
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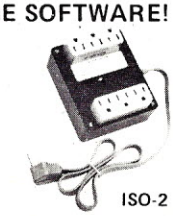
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CIRCLE 18

Computer Goes to Church

Birthdays and Anniversaries

BY WILLIAM KLUNGLE

As church newspaper editors, my wife and I often wondered how we could use our TRS-80 for our church work. One task we've found for the computer is keeping track of church members' birthdays and anniversaries. Both churches and other organizations can use this storage and retrieval program to keep track of information about members.

This program creates, modifies, stores and retrieves information in up to 300 file records at a time. A TRS-80 Level II computer with a 16K memory is required, along with a single cassette recorder to store and retrieve data.

First, I'll explain the subroutines used by various sections throughout the program.

- Subroutine 1000 positions the cursor at particular locations on the video display. This routine retains the proper screen format in spite of errors or corrections. CHR$(28) returns the cursor to the upper left corner of the display. Cursor position (P) is supplied by the program just before this routine is called. CHR$(26) provides one line index down for each execution of loop I.
- Subroutine 1100 provides an indication of entry errors by printing "*ERROR*" at the far right of the line in error. This routine is called by the error checking routines located after each entry line of the program.
- Subroutine 1400 is the printing header used by the various program sections.
- Subroutine 1500 prints a data record in format on the display.
- Subroutine 1600 is called when the display screen is filled with printed records. This routine allows you to continue the printing after having time to read the data, or to return to the program selection menu.
- Subroutine 1700, used by the "Alpha Search" section of the program, attempts to match a requested group of characters with the record currently being addressed. If a match is found, the record is printed in format on the display using subroutine 1500.
- Subroutine 1800 suspends the program when interruption is requested of the "Alpha Search" routine.

Illustration by Donni Richman

When the RUN command is entered, the program begins execution at line 5. Program line 5 clears 11000 bytes of memory for string data storage. Most of this space will be used by the data array (R$) which stores the file records. The data record is defined by the program to a length of 37 bytes. This record length (25 bytes for name, 6 bytes for birthday, 6 bytes for anniversary) allows 6 records to be stored in the memory space normally required for one full size (256 bytes) record. Line 5 also dimensions the data file array (R$) to a size of 300 records.

Program lines 10 and 15 are the selection menu. The ON ERROR statement is a safe-guard in case of an unusual error or data read error which would otherwise terminate the program and result in a loss of data. Line 100 is the beginning of the new entry section. This routine allows deleted records to be automatically filled when new entries are made to the file. This line also clears the screen, prints the current record number and clears (nulls) the name, birthday and anniversary variables. Program line 100 is only executed for New Entries.

Lines 105 through 124 serve to input data for the New Entry and the Correction sections. The variable "P" designates the cursor position at which a particular input request is to be printed. Subroutine 1000 is called to position the cursor. The length of the entries are checked to be sure they conform to the record size requirements and error routine 1100 is called if necessary. Variables N$ and B$ (name and birthday) *require* an entry, variable A$ (anniversary) may be bypassed with a "return" if an anniversary data is not used for the record. After each entry,

Sample Run

```
CHURCH BIRTHDAY/ANNIVERSARY LISTING

 1 = NEW ENTRIES
 2 = LOAD DATA FROM TAPE
 3 = CORRECTIONS
 4 = PRINT LISTING
 5 = DATE SEARCH
 6 = ALPHA SEARCH
 7 = DUMP DATA ON TAPE
 8 = EXIT PROGRAM

SELECT? 5_

SEARCH FILE BY DATE

SEARCH:  1 = BIRTHDAY, 2 = ANNIVERSARY, 0 = RETURN  -?_1_


SEARCH DATE (JAN)  :  ?_JAN_

REC #      NAME              BIRTHDAY   ANNIVERSARY

  1    DANIEL CNOSSEN         JAN 13
  2    VERNON SHUMAKER        JAN 14      JAN 28
  3    FRAN BOESKOOL          JAN 16
  4    BOBBY POWEL            JAN 16
  5    LIN STRABBING          JAN 17      JUL 12
  6    LUELLA KAMMERAD        JAN 20

                    (C=CONTINUE, F=FINISHED)   ?_F
```

the variable is printed in the proper position.

Program line 106 is used only during the Correction function, as deletes can only be made by Correction. Program line 107 fills the name variable (N$) to the required 25 bytes. Line 120 allows the operator to continue the entries, return to the menu or return to the beginning of the current entry for corrections (enter E for error).

Lines 200 through 205 constitute the tape reading section. This section allows the operator to prepare the tape for the data read, reads the tape storage date (D$), and reads in six records at a time. Before returning to read additional records, the program checks the length of the last three records read. If these records are blank, the program automatically returns to the selection menu.

In line 300 the program provides access to individual records to allow correction. If the record (E) requested for correction is empty, the program returns to line 300 to ask for another record number. If the requested record has data, the record is divided into the name, birthday and anniversary variables and subroutine 1200 prints the contents of the record in format on the display. The program is then directed to the beginning of the entry section (105-125). If the entry section is accessed through the correction routine, the variables N$, B$, A$ will contain the data from the record. Entering only a return will leave that particular variable unchanged. If a new entry is made for the input requested, the variable will be changed to reflect the change. After each entry, the data in the variable is printed in the proper position.

Program lines 400 through 410 along with subroutines 1400 and 1500 provide a formatted listing on the display of the records in the file. Each time the display is filled (L=14), the interrupt routine (1600) is called to allow the operator time to read the display, continue or return to the selection menu. The column header is printed at the top of each new page of data.

The program provides several methods of searching the file. Lines 500 through 515 allow the file to be searched for birthdays or anniversaries of a particular month. Line 500 requests the operator to choose a search for either birthday or anniversary month. Variable B is set to the proper starting position of the record depending upon which search is selected. The month of the search is requested and the file is searched for any records which contain the requested month. When a match is found, subroutine 1500 prints the data on the screen. After fourteen records have been displayed on the screen, the interrupt routine is called to allow the operator time to read the display.

Program section 600 through 610 is the "Alpha Search" section. This section allows each record name (first 25 characters) to be searched for a particular sequence of characters. Up to twenty characters may be entered in the search request, the longer the search entry, the more time the program will require to complete the file search. Subroutine 1700 is called for each record and the requested character group is checked against the record. If a match is found, the record data is printed on the display. The search can be suspended at any time you enter an "S". This interrupt lets you exit the search routine in the event the required record is found before the display has been filled.

Data storage on cassette tape is provided by program lines 700 through 705. The current date is requested and stored on the tape to identify the file. Line 705 writes six data records on the cassette at a time. The last three record lengths are checked for data before the record counter (E) is indexed. If all three records are empty, the program assumes the end-of-data has been reached and automatically returns to the selection menu.

Program line 800 provides a last chance to save data before the program terminates. If the operator requested Exit Program, line 800 provides a reminder to the operator that the data in the array will be lost when the program terminates. If the operator responds NO to the question "Has the data been stored?", the program will call the data storage section.

This versatile program can be adapted to various types of material and uses. The input requests and print header can be changed to reflect the desired use. Keep in mind that the

maximum number of characters which can be written to tape in one PRINT#-1 statement is 256. The computer will truncate any additional characters without warning. If the record size is increase, the number of records stored per PRINT#-1 statement must be reduced.

With very little modificatin, many church and other organizations should be able to use this program to store and recall information about members. □

Program Listing

```
1 REM: CHURCH BIRTHDAY/ANNIVERSARY PROGRAM
2 REM: BY WILLIAM KLUNGLE     7/1/79
5 CLEAR11000:DIMR$(300)
10 ONERRORGOTO10:CLS:PRINT"CHURCH BIRTHDAY/ANNIVERSARY LISTING":PRINT:PRINT" 1 = NEW ENTRIES":PRINT" 2 = LOAD DATA FROM TAPE":PRINT"
 3 = CORRECTIONS":PRINT" 4 = PRINT LISTING":PRINT" 5 = DATE SEARCH":PRINT" 6 = ALPHA SEARCH":PRINT" 7 = DUMP DATA ON TAPE"
15 PRINT" 8 = EXIT PROGRAM":PRINT:E=1:C$="":INPUT"SELECT ";S:ONSGOTO100,200,300,400,500,600,700,800:GOTO10
100 IFLEN(R$(E))>1THEN125ELSECLS:PRINT"ENTRY #";E;"     (0=RETURN)":PRINT:N$="":B$="":A$=""
105 P=2:GOSUB1000:INPUT"NAME (25 MAX)       : ";N$:IFN$="0"THEN10ELSEPRINTTAB(22);CHR$(27);"  ";N$:IFLEN(N$)<10RLEN(N$)>25THENGOSUB1
100:GOTO105
106 IFS=3ANDN$="DELETE"THENR$(E)="":GOTO300
107 IFLEN(N$)<25THENN$=N$+" ":GOTO107
110 P=3:GOSUB1000:INPUT"BIRTHDAY (JAN 02)    : ";B$:PRINTTAB(22);CHR$(27);"  ";B$:IFLEN(B$)<>6THENGOSUB1100:GOTO110
115 P=4:GOSUB1000:INPUT"ANNIVERSARY (FEB 09): ",A$:IFS=1ANDA$=""THENA$="      "
116 PRINTTAB(22);CHR$(27);"  ";A$:IFLEN(A$)<>6THENGOSUB1100:GOTO115
120 P=6:Y$="":GOSUB1000:INPUT"MORE ENTRIES  (Y-N-E) ";Y$:IFY$=""THEN120ELSEIFY$="E"THEN105ELSER$(E)=N$+B$+A$:IFY$="N"THEN10ELSEIFY$=
"Y"ANDS=3THEN300
125 E=E+1:IFE>300THEN700ELSE100
200 CLS:PRINT"LOAD DATA FROM TAPE    (0=RETURN)":PRINT:INPUT"SET TAPE TO 'PLAY', ... 'ENTER' WHEN READY...";Y$:IFY$="0"THEN10ELSEE=1:
INPUT#-1,D$:PRINT@330,"TAPE OF ";D$;
205 PRINT@465,"READING FILES # ";E;"-";E+5;:INPUT#-1,R$(E),R$(E+1),R$(E+2),R$(E+3),R$(E+4),R$(E+5):IFLEN(R$(E+3))<1ANDLEN(R$(E+4))<1
ANDLEN(R$(E+5))<1THEN10ELSEE=E+6:IFE>300THEN10ELSE205
300 CLS:PRINT"CORRECTIONS       (COMMANDS:  0=RETURN,  'DELETE')":PRINT:INPUT"CORRECT RECORD # ";E:IFE=0THEN10ELSEIFLEN(R$(E))<1THEN
300ELSECLS:N$=LEFT$(R$(E),25):B$=MID$(R$(E),26,6):A$=MID$(R$(E),32,6):GOSUB1200:GOTO105
400 E=1:GOSUB1400
405 IFR$(E)=""THEN410ELSEGOSUB1500:IFL=14THENGOSUB1600:IFC$="F"THEN10ELSEGOSUB1400
410 E=E+1:IFE<301THEN405ELSEGOSUB1600:GOTO10
500 CLS:PRINT"SEARCH FILE BY DATE":PRINT:INPUT"SEARCH: 1 = BIRTHDAY,  2 = ANNIVERSARY,  0 = RETURN    -";L1:IFL1=0THEN10ELSEPRINT:IN
PUT"SEARCH DATE  (JAN)  : ";S$:IFLEN(S$)<>3THEN500ELSEE=1:GOSUB1400:B=26:IFL1=2THENB=32
510 IFR$(E)=""THEN515ELSEIFS$=MID$(R$(E),B,3)THENGOSUB1500:IFL=14THENGOSUB1600:IFC$="F"THEN10ELSEGOSUB1400
515 E=E+1:IFE<301THEN510ELSEGOSUB1600:GOTO10
600 CLS:PRINT"ALPHA SEARCH SECTION    (0=RETURN)":PRINT" * NOTE:  IF 'S' IS ENTERED DURING SEARCH, SEARCH WILL SUSPEND.":PRINT:INPUT
"SEARCH NAME  (20 CHAR MAX)  : ";S$:IFS$="0"THEN10ELSEIFLEN(S$)>20THEN600ELSEE=1:GOSUB1400
605 X$=INKEY$:IFX$="S"THENGOSUB1800ELSEIFR$(E)=""THEN610ELSE2$=LEFT$(R$(E),25):GOSUB1700:IFI<>0THENGOSUB1500:IFL=14THENGOSUB1600:IFC
$="F"THEN10ELSEGOSUB1400
610 IFC$="F"THEN10ELSEE=E+1:IFE<301THEN605ELSEGOSUB1600:GOTO10
700 CLS:PRINT"DUMP DATA TO TAPE       (0=RETURN)":PRINT:PRINT"SET TAPE TO RECORD DATA...":INPUT"ENTER TODAYS DATE.....";D$:IFD$="
0"THEN10ELSEPRINT#-1,D$:E=1
705 PRINT@465,"DUMPING FILES #";E;"-";E+5:PRINT#-1,R$(E),R$(E+1),R$(E+2),R$(E+3),R$(E+4),R$(E+5):IFLEN(R$(E+3))<1ANDLEN(R$(E+4))<1AN
DLEN(R$(E+5))<1THEN10ELSEE=E+6:IFE>300THEN10ELSE705
800 CLS:Y$="":PRINT@84,"** WARNING **":PRINT"WHEN THE PROGRAM IS TERMINATED, ALL DATA WILL BE LOST!":PRINT:INPUT"HAVE YOU STORED THE
 DATA ON TAPE ";Y$:IFLEFT$(Y$,1)<>"Y"THEN700ELSEEND
1000 PRINTCHR$(28);:FORI=1TOP:PRINTCHR$(26);:NEXTI:RETURN
1100 PRINTTAB(55);CHR$(27);"* ERROR *":RETURN
1200 PRINT@152,N$:PRINT@216,B$:PRINT@280,A$:RETURN
1400 CLS:PRINT"REC #";TAB(15);"NAME";TAB(40);"BIRTHDAY";TAB(50);"ANNIVERSARY":PRINT:L=2:RETURN
1500 PRINTTAB(1);E;TAB(10);LEFT$(R$(E),25);TAB(41);MID$(R$(E),26,6);TAB(52);MID$(R$(E),32,6):L=L+1:RETURN
1600 C$="":PRINT@990,"(C=CONTINUE, F=FINISHED)  ";:INPUTC$:RETURN
1700 FORI=1TOLEN(Z$)-LEN(S$)+1:IFS$=MID$(Z$,I,LEN(S$))RETURN
1710 NEXTI:I=0:RETURN
1800 C$="":PRINT@900,"-- BREAK --  C=CONTINUE, F=FINISH   ";:INPUTC$:CLS:GOSUB1400:RETURN
```

BACKGAMMON

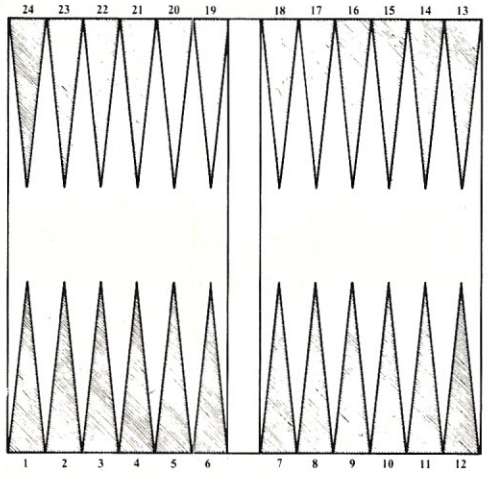
BY WILLIAM LAPPEN

Backgammon, an ancient game of luck and skill, is played on a board with 24 lines arranged six per quadrant. Each player has 15 "men" (yes, that is what they are called — the game dates back to ancient Egypt). One player moves his men clockwise and the other moves counter-clockwise. The object is to get all of your men into your "home" board (quadrant) and then take them off of the board before the other player gets his men off. The game is slightly confusing at first, but after playing a few times, you'll find the rules are quite simple. Strategy is much more difficult.

This program is written for a DEC-10, but the BASIC is pretty much standard. It should run on most microcomputers with 16K RAM.

But before we discuss the program, let's look at the game itself. It will help at first if you have a board to follow the moves on. If you don't have a backgammon board (or the back side of a checker board — it's the one with the funny triangles), take a piece of notebook paper and mark 24 lines on it. (See Figure 1.)

Figure 1



For the pieces, you can use 15 pennies and 15 nickels. The board is initially set up as shown in Figure 2.

Figure 2

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
5	0	0	0	−3	0		−5	0	0	0	0	2	0
−5	0	0	0	3	0		5	0	0	0	0	−2	0
12	11	10	9	8	7		6	5	4	3	2	1	

Roll the dice?

I numbered the points (lines) to make it easier to tell the computer where to move the pieces. The computer will move in a clockwise direction, starting from position 1 and ending in the quadrant numbered from 19 to 24 (its home board). You, the challenger, will move in a counter-clockwise direction, starting at position 24 and moving to the quadrant numbered from 6 to 1 (your home board). Your men are the positive numbers and the computer's are the negative numbers. For example, you have 5 men on point 6 (in your home board) and the computer has 2 men on point 1 (also in your home board). There are no men on point 10.

To illustrate the game and the program, I will use actual moves made in play against the computer. The program plays a reasonably good game. Since there's quite a bit of luck involved in backgammon (more on that later), the computer can be expected to win about 50% of the time. (If two players are equally skilled, luck will decide the game.) This program has beaten me about 30% of the time using my own strategy. It's had much better results playing against people who do not know the intimate details of the strategy.

To start the game, each player rolls one die. The player getting the higher number uses both die to move his men. Let's assume that the computer rolls a 3 and you roll a 6. (Of course, the computer does the rolling for you, but it doesn't cheat — perhaps this suggests an additional feature you want to implement!) Since you got the higher number, you get to move first. You may move any of your men 3 and any of them 6, or the same one may move both 3 and 6 (9) points in a counter-clockwise direction. You cannot move past the 1 point in your home board yet. Also, you may not land on any point occupied by two or more of your opponent's men.

So on a 3, 6 roll, you may move both men from the 24 point (one would go to 21 and the other would go to 18); or you may move one man from 24 to 15; or you may move one from 13 to 7 and then from 7 to 4 . . . . You may not move from point 6 using the 6 on the dice because that will take you off of the board and you can't do that yet. Let's say that you decide to move from point 13 to point 10 and from point 13 to point 7. The board will then look like Figure 3 (remember, you are the positive numbers).

Figure 3

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
3	0	0	0	−3	0		−5	0	0	0	0	2	0
−5	0	1	0	3	1		5	0	0	0	0	−2	0
12	11	10	9	8	7		6	5	4	3	2	1	

Let's go one more move just to see how the computer will move. Let's assume that it rolled a 4 and a 1. The computer is moving its men in a clockwise direction, trying to end up in its home quadrant (19 to 24). It may move from 1 to 5, but it cannot move from 5 to 6 since there are two or more of your men on the 6 point. Similarly, it can't move from 12 to 13, but it can move from 12 to 16 (it can move past, just as long as it doesn't land on a point with 2 or more of your men on it). Let's assume that the computer moved from 12 to 16 and from 16 to 17. Then the board looks like Figure 4.

Figure 4

DICE: 4

MY MOVE

From 12 to 16

From 16 to 17

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
3	0	0	0	−4	0		−5	0	0	0	0	2	0
−4	0	1	0	3	1		5	0	0	0	0	−2	0
12	11	10	9	8	7		6	5	4	3	2	1	

Now let's complicate the game a little bit. Go back to the positions in Figure 3 (before the computer made its move). Notice that you have two points with only one man on them (7 and 10). If the computer could move so it landed on your "blot" (a single man), that man would be placed on the "bar" (over to the right) and would have to re-enter the board in the computer's home board before you could move any other pieces. If the computer rolled a 6, 2, it could force you to start one man over again. The computer could move from 1 to 7 (hitting your man on the 7 point) and then from 7 to 9. The board would look like Figure 5.

Figure 5

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
3	0	0	0	−3	0		−5	0	0	0	0	2	0
−5	0	1	−1	3	0		5	0	0	0	0	−1	1
12	11	10	9	8	7		6	5	4	3	2	1	

If you were to roll a 5, 6, you would be able to "come in" from the bar on the 5, but not on the 6 (the computer has more than one man on the 19 point, which is 6 from the 24 point moving in a counter-clockwise direction). Thus you could move from the bar to 20 and from 20 to 14 (see Figure 6).

Figure 6

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
3	1	0	0	−3	0		−5	0	0	0	0	2	0
−5	0	1	−1	3	0		5	0	0	0	0	−1	0
12	11	10	9	8	7		6	5	4	3	2	1	

Some other important rules: You must move the number shown on the dice if possible. If not, you must pass up moving on that die; you can't move a different number until ready to end the game — bearing off. Also, if you roll doubles, you get to move four times the number shown. For example, if you throw double 3s, you may move four 3s (one man may move 12 by 3s or two may move 6 or four may move 3).

When you (or your opponent) get all of your men in your home board, you start taking them off of the board. All of the rules are the same, except one: If you can't move the full number shown on the dice, you may move less. For example, if you had 3 men on the 2 point and 2 on the 4 point and rolled a 4,5, you could take one man off the 4 point. Now you have the 5 to move. But there is nothing on the board to move 5. Since you are "bearing off", you are allowed to take a man off of the highest point (4).

I realize that the rules are a bit sketchy right now. It is not my purpose to teach you the game of backgammon. There are many good books on the subject and the program itself has may tutorial functions. So now let's turn to strategy.

The program is broken into two parts. The first part is the opponent's move, which the computer verifies. The second part is for the computer's move. This section is further divided into two main parts. The first part generates all of the possible moves and the second part evaluates them.

Let's first concentrate on the method of generating all possible moves given a certain roll and board position. This task is more complex than it seems and represents one area where the computer may play better than a human. For example, how many moves are possible in Figure 7?

Figure 7

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
0	0	0	0	−3	−2		−3	0	0	−6	0	1	0
0	2	0	0	3	2		3	2	2	0	0	−1	0
12	11	10	9	8	7		6	5	4	3	2	1	

The computer has rolled a 2,6. Well, it could move from point 1 to point 3 and then from 3 to 9. Or it could move from 17 to 23 and from 18 to 20 . . . . There are 11 different valid moves in the given position.

The algorithm that I used to determine the available moves starts first at the 1 point and sees if any of the computer's men are there. If not, then it goes to the 2 point, and so on. As soon as a man is found, the computer tries to move it the number shown on die 1 (D(1) in the program). If the computer can

move the man that amount, it will do so and then start looking for a move to make with the second die. It continues from that point, rather than restarting at the 1 point. The reason is that the only thing that will be changed by moving a piece the amount shown on die 1 will be in front of where the move was made (higher numbers on the board).

When all possible moves have been generated and evaluated, the program switches the order of the dice and starts over. This time, all valid moves are sent to be evaluated except cases where one man is moved using both dice with none of the opponent's men on the intermediate points. Also, when two men are moved from the same point, the computer will not evaluate the same move the second time.

To see how this algorithm works, let's use the above configuration of the board (Figure 7). The computer has rolled a 2,6 in that order. The first move to be evaluated is from 1 to 3 and from 3 to 9. Once that move is evaluated, the computer will reset the second move (3 to 9) and search for another move to make with the 6. The next move is 1 to 3 and 17 to 23. One more move can be made using the dice in this order and moving from point 1 to 3. This move is 1 to 3 and 18 to 24.

Now the computer will reset the second piece (moved with die 2) and determine that no more moves can be made from line 1. At this point, it resets the first move and searches for the next piece that can be moved 2. The next move would be 17 to 19 and 17 to 23. Then 17 to 19 and 18 to 24; and then 18 to 20 and 18 to 24.

Now all of the moves are finished for the dice in the order rolled, so the computer switches the order and restarts the move generator. The moves that it comes up with now are: 17 to 23 and 18 to 20; 17 to 23 and 19 to 21; 17 to 23 and 22 to 24; 18 to 24 and 19 to 21; 18 to 24 and 22 to 24. Notice that the computer will not evaluate 17 to 19 and 17 to 23 this time since this move is the same as 17 to 23 and 17 to 19 and has already been evaluated.

Figure 8

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
3	0	0	−1	−2	0		−4	0	0	−2	0	2	0
−5	0	0	0	3	1		4	−1	2	0	0	0	0
12	11	10	9	8	7		6	5	4	3	2	1	

Correct?

DICE:				4	5
5	9	9	14	− 985.349	
5	9	12	17	−1346.48	
5	9	16	21	−1989.62	
5	9	17	22	−1680.03	
12	16	12	17		− 707.508
12	16	16	21		−1899.57
12	16	17	22		−1035.29
16	20	17	22		−1736.88
17	21	17	22		−2000.85
5	10	12	16		-941.599
5	10	16	20		−1785.11
5	10	17	21		−2214.43
5	10	19	23		−2134.42
12	17	16	20		−1544.02
12	17	19	23		−1893.33
16	21	17	21		− 998.842
16	21	19	23		−1657.53
17	22	19	23		−2153.08

MY MOVE

From 12 to 16
From 12 to 17

Special rules are provided for bringing a man back in from the bar when the computer's man has been hit and for bearing off at the end of the game. Also, if the computer can move with only one die, that situation presents different problems which are taken care of by the program. Doubles will increase the number of iterations and the number of possible moves, but the procedure for generating the moves remains the same (except the dice aren't switched).

As a further example of the move generator, notice the moves that can be made from the position in Figure 8.

The moves are the leftmost four numbers and the relative value that the evaluation subroutine assigned to the moves are the rightmost numbers. The moves are "from" and "to". So the first move that was evaluated was from 5 to 9 and from 9 to 14.

Now that we have seen how the moves are generated, let's see how they are analyzed. Let's assume the board is as shown in Figure 9 and it is the computer's roll.

Figure 9

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
2	0	0	0	−4	0		−2	−2	1	−3	0	1	0
−2	0	0	0	2	2		3	2	2	0	−1	−1	0
12	11	10	9	8	7		6	5	4	3	2	1	

Analyzing the position shows the opponent is in much better position that the computer. Notice the solid "prime" from the 8 point to the 4 point (two or more men on each of the points). The computer will need to use both dice to move only one of its men out of there. It can get the man on the 2 point out only with a 1,6; and the man on the 1 point can get out only with a 2,6. Chances are pretty slim of getting those combinations. You can figure probability by setting up a table (Figure 10).

Figure 10

	DIE 1					
DIE 2	1	2	3	4	5	6
1	1	1	1	1	1	1
2	1	1	1	1	1	1
3	1	1	1	1	1	1
4	1	1	1	1	1	1
5	1	1	1	1	1	1
6	1	1	1	1	1	1

The probability of getting a 6 on die one and a 1 on die two is 1/36. Of course, the computer wouldn't care if it got the 1 on die one and the 6 on die two. Therefore, the probability of getting a 6 and a 1 is 2/36. Similarly, the probability of getting a 6 and a 2 is 2/36. Therefore, the probability of the computer getting one man out of your home board is 4/36.

As another example, the probability of the computer rolling a total of 7 is 6/36, (1,6; 2,5; 3,4; 4,3; 5,2; 6,1). The computer generates the probabilities in lines 5350 through 6090. The probabilities generated include doubles and exclude illegal moves where the player would have to land on a line with more than one of the opponent's men on it.

To see how this probability function works, let's assume the computer rolls a 3,5 in the position illustrated in Figure 9. Lines 2800 to 3240 of the program generate all legal moves.

If the move hasn't been evaluated before, it is sent to the evaluation subroutine (starting at line 4280). (More on this part of the program later.) Suppose the computer has generated the move 12 to 15 and 17 to 22. The board is updated (Figure 11) and sent to the evaluation subroutine.

Figure 11

BOARD

13	14	15	16	17	18		19	20	21	22	23	24	BAR
2	0	−1	0	−3	0		−2	−2	1	−4	0	1	0
−1	0	0	0	2	2		3	2	2	0	−1	−1	0
12	11	10	9	8	7		6	5	4	3	2	1	

The computer has two blots to evaluate. What are the chances that you could hit either or both of them? And what harm would it do if you did? To fully answer these questions, we need to look deeper into more strategy.

First, let's get the probability of hitting the computer's blots. The evaluation subroutine fills array B with the location of the computer's blots (program lines 4630 to 4700). Now the computer determines that the probability of getting a 1 on either (or both) die is 11/36 (not 12/36, since you don't count double 1s twice). This number is used in the probability functions that evaluate the whole move.

Then the computer determines the odds that you could hit it from the 21 point. The difference here is 9. The probability of getting a total of 9 is 5/36 (6,3; 5,4; 4,5; 3,6; 3,3 — three 3s would be 9).

But are all of those rolls valid for you to be able to hit? The computer has three covered points (more than one man per point) that you can't land on. For example, if you were to roll a 4,5 you couldn't move the 4 first (that would put you on the 17 point) but you could move the 5 first. Therefore, 5,4 and 4,5 are valid. Similarly, 6,3, 3,3 and 3,6 are valid rolls. So the probability really is 5/36 for this situation.

Now the odds of hitting the computer's blot on the 12 point from the 24 point must be considered. The distance is 12, so you'd need doubles. (The farthest you can move without doubles is 11). Double 3, 4 or 6 would allow you to move the distance of 12. Checking validity shows that double 4s are out (you couldn't move the first one). Therefore, the odds of hitting the computer at the 12 point from the 24 point are 2/36.

After generating each of these numbers, the computer evaluates many factors to determine whether it's worthwhile to hit. For example, your home board has three covered points on it. Thus the computer's odds of getting back in (assuming it gets hit) would be 27/36 — not too bad. But once the computer gets in, it would have to move past your prime of 5 points — much more difficult. (We've already computed the probability of getting the man out from the 2 point to be 2/36.) Therefore, there should be quite a deterrence factor given to leaving the blot exposed. The value shouldn't be too high (here you can "fine tune" the program) because it may be worthwhile taking certain risks.

The computer also takes into account that if you were to hit it from the 12 point, you would most likely have to leave at least one blot. Hence, you wouldn't be very anxious to hit (program lines 5410 to 5640). The computer would do the same for its blot on the 15 point and would aggregate the whole value of this position (represented in array B1) in V and send it back to the main program.

When evaluating the value of hitting one of your blots, the computer will also evaluate your odds of getting in and the problems you'll have getting out of its home board (lines 5080 to 5130). Other evaluated factors are named in the remarks right before the code that does the evaluation. I have found that the best positions to occupy (build a covered point on) are the 7,6 and 5 (the opposite in the computer's home board — but it helps if you can block it from building those points). Therefore, special value functions encourage this (lines 6330 to 6420). Also, the computer tends to play a conservative game. Thus, it's necessary to force it to take risks (like move out of your home board). These penalties are scattered throughout the evaluation subroutine (where the variables are computed).

To change the strategy of the computer's play, try changing some of the values in any of the value functions. For example, to decrease the emphasis the computer places on the number of points in the home boards (thus making the computer play a riskier game), change the value of V1 in line 460 to 2. This value is used in lines 5060 and 5070 to increase the value of home boards exponentially. Or you may decide that the value of home boards is related linearly — so change 5060 and 5070 to multiplication.

No matter which changes you make, the only way to test the theories you are using is to run the program a few times and notice the moves that are being made. The value functions are currently "balanced" to give rational decisions in most situations. Since the value is computed throughout the entire evaluation subroutine, you'll need to bring the value functions back into balance. This rebalancing will also teach you quite a bit about the game and strategy of backgammon.

The main program generates all legal moves and uses the one that yields the highest value. There's a one move look-ahead since the game is very much dependent on the luck of the dice. This look-ahead seems sufficient to insure that the computer can play almost as well as a human.

The program features tutorial aspects also. If you're just learning how to play backgammon, it will teach you the game and some strategy. Of course, it verifies all of your moves before allowing you to make them. But it also lets you look at the way it evaluates moves. After seeing the program's value system, you may decide to try certain strategies to beat it. At this point, you would do well to change the program's strategy (as discussed previously) and then see how the changes affect your strategy.

To get the *relative* values for each move, answer the second question (about whether you want to see the way the program values move) with a yes. After the computer rolls the dice for itself, it will print the move and relative value. For example, it might print:

12 15 16 22 1020

The program considered moving from 12 to 15 and then from 16 to 22. The move was given a relative value of 1020. You can't really tell what the value means until the computer evaluates all of its moves. Like us, it expresses joy or despair depending on the rolls that it gets. Joy is expressed with higher numbers (or less negative numbers) and despair shows with lower numbers. The computer will still try to choose the best of the possible moves, even when expressing intense despair.

I have included parts of a game played against the computer to illustrate further points and to provide you with a check on the program. In this game, the computer emerged victorious. Oh well, I guess I can't win them all! □

Program Notes

Line 20 opens a disk file that holds the score of all past games.

Lines 1900 and 1910 (and 6980 and 6990) get the record in the file so that the computer may print out the previous score incremented depending on who won (line 7430).

Lines 7010 and 7020 write the updated score back on the disk.

If you do not have a disk, you may want to keep score on tape, or forget about the cumulative score. The program will run equally well by deleting all references to the disk file. (Delete lines 20, 1900, 1910, 1920, 6980, 6990, 7000, 7010, 7020 and change 1940 to GOTO 7410. Also, delete 7420 and 7430.)

Sample Run

Opening Game

```
BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     5   0   0   0  -3   0    -5   0   0   0   0   2          0

    -5   0   0   0   3   0     5   0   0   0   0  -2          0
     12  11  10  9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          3                1
               MY MOVE
FROM  17  TO  20
FROM  19  TO  20

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     5   0   0   0  -2   0    -4  -2   0   0   0   2          0

    -5   0   0   0   3   0     5   0   0   0   0  -2          0
     12  11  10  9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          6                1
YOUR MOVE (FROM, TO) ?8,7
YOUR MOVE (FROM, TO) ?13,7

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     4   0   0   0  -2   0    -4  -2   0   0   0   2          0

    -5   0   0   0   2   2     5   0   0   0   0  -2          0
     12  11  10  9   8   7     6   5   4   3   2   1
```

Mid Game

```
BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0  -2  -2    -4  -2  -3   0  -2   1          0

     0   0   0   0   0   0     2   2   2   4   0   4          0
     12  11  10  9   8   7     6   5   4   3   2   1

CORRECT ?

DICE:          3                6
               MY MOVE
FROM  18  TO  24
FROM  21  TO  24

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0  -2  -1    -4  -2  -2   0  -2  -2          0

     0   0   0   0   0   0     2   2   2   4   0   4          1
     12  11  10  9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          5                4
THAT'S IT FOR YOUR TURN

DICE:          5                3
               MY MOVE
FROM  18  TO  21
FROM  19  TO  24

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0  -2   0    -3  -2  -3   0  -2  -3          0

     0   0   0   0   0   0     2   2   2   4   0   4          1
     12  11  10  9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          6                6
THAT'S IT FOR YOUR TURN

DICE:          5                3
               MY MOVE
FROM  19  TO  24
FROM  21  TO  24

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0  -2   0    -2  -2  -2   0  -2  -5          0

     0   0   0   0   0   0     2   2   2   4   0   4          1
     12  11  10  9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          2                3
MOVE FROM BAR TO  ?22
YOUR MOVE (FROM, TO) ?3,1
```

```
CORRECT ?

DICE:          3              2
               MY MOVE
FROM  12  TO  15
FROM  15  TO  17

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     4   0   0   0  -3   0    -4  -2   0   0   0   2         0

    -4   0   0   0   2   2     5   0   0   0   0  -2         0
     12  11  10   9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          3              6
YOUR MOVE (FROM, TO) ?24,18
YOUR MOVE (FROM, TO) ?13,10

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     3   0   0   0  -3   1    -4  -2   0   0   0   1         0

    -4   0   1   0   2   2     5   0   0   0   0  -2         0
     12  11  10   9   8   7     6   5   4   3   2   1

CORRECT ?

DICE:          4              5
               MY MOVE
FROM  1   TO  5
FROM  5   TO  10

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     3   0   0   0  -3   1    -4  -2   0   0   0   1         0

    -4   0  -1   0   2   2     5   0   0   0   0  -1         1
     12  11  10   9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          5              1
MOVE FROM BAR TO  ?24
YOUR MOVE (FROM, TO) ?6,5
CREATIVE, BUT WRONG
YOUR MOVE (FROM, TO) ?13,8

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     2   0   0   0  -3   1    -4  -2   0   0   0   2         0

    -4   0  -1   0   3   2     5   0   0   0   0  -1         0
     12  11  10   9   8   7     6   5   4   3   2   1

CORRECT ?

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0  -2   0    -2  -2  -2   1  -2  -5         0

     0   0   0   0   0   0     2   2   2   3   0   5         0
     12  11  10   9   8   7     6   5   4   3   2   1

CORRECT ?
```

End Game

```
BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0   0   0     0   0   0   0   0  -3         0

     0   0   0   0   0   0     0   0   0   1   1   5         0
     12  11  10   9   8   7     6   5   4   3   2   1

CORRECT ?

DICE:          4              5
               MY MOVE
BEAR OFF FROM  24
BEAR OFF FROM  24

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0   0   0     0   0   0   0   0  -1         0

     0   0   0   0   0   0     0   0   0   1   1   5         0
     12  11  10   9   8   7     6   5   4   3   2   1

ROLL THE DICE ?
DICE:          5              2
YOUR MOVE (FROM, TO) ?2,0
YOUR MOVE (FROM, TO) ?3,0

BOARD

     13  14  15  16  17  18    19  20  21  22  23  24        BAR
     0   0   0   0   0   0     0   0   0   0   0  -1         0

     0   0   0   0   0   0     0   0   0   0   0   5         0
     12  11  10   9   8   7     6   5   4   3   2   1

CORRECT ?


DICE:          2              2
I WIN!!!

COMPUTER       CHALLENGERS
 4              8
DO YOU WANT TO PLAY ANOTHER GAME (Y/N) ?N
```

Program Listing

```
10 REM 9/8/78
20 FILES BG%
30 PRINT
40 PRINT,,"BACKGAMMON"
50 PRINT
60 PRINT
70 PRINT "IF YOU WANT INSTRUCTIONS, TYPE 'Y'";
80 INPUT A$
90 IF A$<>"Y" GOTO 250
100 PRINT
110 PRINT "YOU ARE GOING TO CHALLENGE THE COMPUTER TO AN"
120 PRINT "ANCIENT GAME OF LUCK AND SKILL.  YOUR HOME BOARD"
130 PRINT "IS NUMBERED FROM 1 TO 6.  THE COMPUTER'S HOME"
140 PRINT "BOARD IS NUMBERED FROM 19 TO 24.  TO ROLL THE DICE,"
150 PRINT "HIT THE 'RETURN' KEY.  THE POSITIVE NUMBERS ARE YOUR"
160 PRINT "MEN AND THE NEGATIVE ONES ARE THE COMPUTER'S.  TO"
170 PRINT "MAKE A MOVE, ENTER THE POSITION YOU WISH TO MOVE"
180 PRINT "FROM, A COMMA, AND THE DESTINATION.  IF YOU WANT"
190 PRINT "TO BEAR OFF, THE DESTINATION IS '0'.  IF YOU CAN'T"
200 PRINT "MOVE, TYPE '0,1' FOR YOUR MOVE.  IF YOU WANT TO"
210 PRINT "SEE THE BOARD, TYPE '-1,1' FOR YOUR MOVE.  TO"
220 PRINT "STOP THE GAME, TYPE '0,0' FOR YOUR MOVE.  GOOD LUCK!"
230 PRINT
240 PRINT
250 PRINT "IF YOU WANT TO SEE THE WAY I VALUE MOVES, TYPE 'Y'";
260 INPUT A$
270 F9=0
280 IF A$<>"Y" GOTO 300
290 F9=1
300 DIM B(10),B0(4),B1(26),D(4),H(5),M(9),T(4)
310 REM B IS BLOTS LEFT
320 REM B1 IS BOARD
330 REM D IS DICE
340 REM H IS HITS
350 REM T IS TEMPORARY MOVE (PROPOSED)
360 PRINT
370 RANDOM
380 REM SET UP BOARD
390 DATA 24,2,19,-5,17,-3,13,5,12,-5,8,3,6,5,1,-2
400 FOR I=1TO 26
410 B1(I)=0
420 NEXT I
430 FOR I=1 TO 8
440 READ J,B1(J)
450 NEXT I
460 V1=4
470 V4=3
480 REM PRINT OUT BOARD
490 GOSUB 3770
500 REM ROLL OPENING ROLL
510 GOSUB 4040
1160 REM CHECK IF CAN BEAR OFF
1170 FOR K=7 TO 26
1180 IF B1(K)>0 GOTO 1340
1190 NEXT K
1200 REM MAY BEAR OFF
1210 FOR K1=1 TO F
1220 IF D(K1)>99 GOTO 1330
1230 REM DIE K1 TO BE MOVED
1240 FOR K=6 TO 1 STEP -1
1250 IF K<D(K1) GOTO 1270
1260 IF B1(K)>0 GOTO 1360
1270 NEXT K
1280 FOR K=6 TO 1 STEP -1
1290 IF B1(K)<1 GOTO 1320
1300 T1=K
1310 GOTO 1360
1320 NEXT K
1330 NEXT K1
1340 L=F
1350 GOTO 2010
1360 PRINT "YOU CAN MOVE FROM ";K;" TO ";K-T1;""
1370 GOTO 930
1380 IF I<25 GOTO 1410
1390 PRINT "TRY AGAIN"
1400 GOTO 930
1410 IF B1(I)>0 GOTO 1440
1420 PRINT "YOU HAVE NOBODY ON " I
1430 GOTO 930
1440 IF B1(J)>-2 GOTO 1480
1450 PRINT "I AM ALREADY AT ";J;""
1460 GOTO 930
1470 REM GET DIE MOVED
1480 FOR K=F TO 1 STEP -1
1490 IF (I-J)<>D(K) GOTO 1530
1500 LET D(K)=D(K)*100
1510 T(K)=I
1520 GOTO 1570
1530 NEXT K
1540 PRINT "CREATIVE, BUT WRONG"
1550 GOTO 930
1560 REM MOVE PIECE FROM I TO J
1570 B1(I)=B1(I)-1
1580 IF B1(J)<>-1 GOTO 1640
1590 REM HIT COMPUTER'S PIECE
1600 B1(25)=B1(25)-1
1610 O1=O1+1
1620 H(O1)=J
1630 B1(J)=0
1640 B1(J)=B1(J)+1
1650 GOTO 2010
1660 REM CHECK BEARING OFF
1670 FOR K=7 TO 26
1680 IF B1(K)>0 GOTO 1980
1690 NEXT K
1700 IF B1(I)>0 GOTO 1730
1710 PRINT "YOU HAVE NOBODY ON "; I
1720 GOTO 930
1730 REM BEAR OFF
1740 FOR K=F TO 1 STEP -1
1750 IF D(K)=I GOTO 1860
1760 NEXT K
1770 FOR K=I+1 TO 6
1780 IF B1(K)>0 GOTO 1840
```

```
520 IF D(1)>D(2) GOTO 2340
530 IF D(1)=D(2) GOTO 510
540 GOTO 580
550 REM OPPONENT MOVES NOW
560 GOSUB 3770
570 GOSUB 4040
580 FOR I=1 TO F
590 H(I)=0
600 NEXT I
610 O1=0
620 FOR L=1 TO F
630 IF B1(26)=0 GOTO 930
640 REM OPPONENT HAS A MAN ON THE BAR
650 FOR J=1 TO F
660 K=D(J)
670 IF K>6 GOTO 690
680 IF B1(25-K)>-2 GOTO 720
690 NEXT J
700 PRINT "THAT'S IT FOR YOUR TURN"
710 GOTO 2300
720 PRINT "MOVE FROM BAR TO ";
730 INPUT J
740 IF J<>-1 GOTO 790
750 REM REDISPLAY BOARD AND DIE TO MOVE
760 GOSUB 3770
770 GOSUB 4210
780 GOTO 720
790 IF J<1 GOTO 870
800 IF J>24 GOTO 870
810 IF B1(J)>-2 GOTO 840
820 PRINT "I AM ALREADY THERE"
830 GOTO 720
840 FOR I=1 TO F
850 IF D(I)=25-J GOTO 890
860 NEXT I
870 PRINT "YOU CAN'T DO THAT!"
880 GOTO 720
890 B1(26)=B1(26)-1
900 T(I)=26
910 D(I)=D(I)*100
920 GOTO 1580
930 PRINT "YOUR MOVE (FROM, TO)";
940 INPUT I,J
950 IF I>-1 GOTO 1000
960 REM REDISPLAY BOARD AND DIE TO MOVE
970 GOSUB 3770
980 GOSUB 4210
990 GOTO 930
1000 IF I=0 GOTO 1050
1010 IF I>24 GOTO 1390
1020 IF J>24 GOTO 1390
1030 IF J=0 GOTO 1660
1040 GOTO 1380
1050 REM OPPONENT CAN'T MOVE ANY MORE
1060 IF J=0 GOTO 7380
1070 FOR K=1 TO 24
1080 IF B1(K)<1 GOTO 1150
1090 FOR K1=1 TO F
1100 IF D(K1)>99 GOTO 1140
1110 T1=D(K1)
1120 IF K-T1<1 GOTO 1140
1130 IF B1(K-T1)>-2 GOTO 1360
1140 NEXT K1
1150 NEXT K
1790 NEXT K
1800 FOR K=1 TO F
1810 IF D(K)>99 GOTO 1830
1820 IF D(K)>I GOTO 1860
1830 NEXT K
1840 PRINT "COUNT AGAIN"
1850 GOTO 930
1860 B1(I)=B1(I)-1
1870 FOR K1=1 TO 6
1880 IF B1(K1)>0 GOTO 1950
1890 NEXT K1
1900 SET 1,1
1910 READ :1,C,O
1920 O=O+1
1930 PRINT "CONGRATULATIONS!!!"
1940 GOTO 7010
1950 T(K)=I
1960 D(K)=D(K)*100
1970 GOTO 2010
1980 REM ERROR
1990 PRINT "NOT QUITE YET"
2000 GOTO 930
2010 REM DRAW TENTATIVE MOVE
2020 NEXT L
2030 GOSUB 3770
2040 PRINT "CORRECT";
2050 INPUT A$
2060 IF A$="Y" GOTO 2300
2070 IF A$="" GOTO 2300
2080 IF A$<>"N" GOTO 2040
2090 REM PUT EVERYTHING BACK AND RE-ENTER MOVES
2100 FOR I=1 TO F
2110 IF D(I)<100 GOTO 2200
2120 D(I)=INT(D(I)/100)
2130 K=D(I)
2140 K1=T(I)
2150 B1(K1)=B1(K1)+1
2160 IF K1-K<1 GOTO 2200
2170 IF K1<>26 GOTO 2190
2180 K1=25
2190 B1(K1-K)=B1(K1-K)-1
2200 NEXT I
2210 IF O1=0 GOTO 2260
2220 FOR I=1 TO O1
2230 B1(H(I))=-1
2240 B1(25)=B1(25)+1
2250 NEXT I
2260 GOSUB 3770
2270 GOSUB 4210
2280 PRINT "RE-ENTER MOVES"
2290 GOTO 580
2300 REM COMPUTER MOVES NOW
2310 PRINT
2320 REM ROLL DICE
2330 GOSUB 4070
2340 M(9)=-9999999
2350 FOR T1=1 TO F
2360 H(T1)=0
2370 NEXT T1
2380 REM F2 SIGNALS DICE HAVE BEEN SWITCHED
2390 F2=0
2400 REM F4 IS NUMBER OF MEN MOVED FROM BAR
2410 F4=0
2420 IF B1(25)=0 GOTO 2790
```

```
2430 REM MEN ON BAR
2440 IF B1(D(1+F4))<2 GOTO 2520
2450 J1=F4
2460 IF F4=0 GOTO 2480
2470 GOSUB 3290
2480 GOTO 3420
2490 IF F=1 GOTO 3550
2500 PRINT "YOU DIRTY RAT"
2510 GOTO 570
2520 REM MOVE FROM BAR
2530 F4=F4+1
2540 REM COME IN ON DIE F4
2550 B1(25)=B1(25)+1
2560 K=D(F4)
2570 B1(K)=B1(K)-1
2580 IF B1(K)<>0 GOTO 2640
2590 FOR K1=1 TO F
2600 IF H(K1)=0 GOTO 2620
2610 NEXT K1
2620 H(K1)=K
2630 B1(K)=-1
2640 T(F4)=25
2650 J1=F4+1
2660 IF F4<F GOTO 2420
2670 GOSUB 4280
2680 REM SPECIAL RESET
2690 FOR K=1 TO F4
2700 K1=D(K)
2710 B1(K1)=B1(K1)+1
2720 IF H(K)=0 GOTO 2740
2730 B1(K1)=1
2740 B1(25)=B1(25)-1
2750 M(K*2-1)=25
2760 M(K*2)=D(K)
2770 NEXT K
2780 GOTO 3550
2790 IF F4<>0 GOTO 2820
2800 J1=1
2810 REM J1 IS NUMBER OF DIE TO BE USED FOR THE MOVE
2820 N=1
2830 REM N IS USED TO REFERENCE POSITIONS ON THE BOARD
2840 FOR K=1 TO 18
2850 IF B1(K)<0 GOTO 2890
2860 NEXT K
2870 REM READY TO BEAR OFF
2880 GOTO 6840
2890 IF B1(N)<=-1 GOTO 2980
2900 N=N+1
2910 IF N<=24 GOTO 2890
2920 REM TRIED ALL MOVES FOR DIE J1 GIVEN MOVE T(J1-1)
2930 J1=J1-1
2940 IF J1<1 GOTO 3420
2950 N=T(J1)+1
2960 GOSUB 3290
2970 GOTO 2890
2980 REM TRY TO MOVE B1(N)
2990 K=D(J1)
3000 IF N+K>24 GOTO 2930
3010 IF B1(N+K)>=2 GOTO 2900
3020 REM MOVE B1(N)
3030 T(J1)=N
3040 B1(N)=B1(N)+1
3050 B1(N+K)=B1(N+K)-1
3700 K=M(I*2)
3710 B1(K)=B1(K)-1
3720 IF B1(K)<>0 GOTO 3750
3730 B1(26)=B1(26)+1
3740 B1(K)=-1
3750 NEXT I
3760 GOTO 550
3770 REM SUBROUTINE TO DRAW BOARD
3780 PRINT
3790 PRINT "BOARD"
3800 PRINT
3810 FOR I=13 TO 24
3820 K=INT ((I-1)/6-2)*2
3830 PRINT TAB ((I-12)*4+K);I;
3840 NEXT I
3850 PRINT TAB (60);"BAR"
3860 FOR I=13 TO 24
3870 K=INT((I-1)/6-2)*2
3880 PRINT TAB ((I-12)*4+K);B1(I);
3890 NEXT I
3900 PRINT TAB (60);B1(25)
3910 PRINT
3920 FOR I=12 TO 1 STEP -1
3930 K=INT ((12-I)/6)*2
3940 PRINT TAB ((13-I)*4+K);B1(I);
3950 NEXT I
3960 PRINT TAB (60);B1(26)
3970 FOR I=12 TO 1 STEP -1
3980 K=INT((12-I)/6)*2
3990 PRINT TAB((13-I)*4+K);I;
4000 NEXT I
4010 PRINT
4020 PRINT
4030 RETURN
4040 REM SUBROUTINE TO ROLL DIE
4050 PRINT "ROLL THE DICE";
4060 INPUT A$
4070 FOR K=1 TO 2
4080 D(K)=INT(RND*5.999999+1)
4090 K1=RND*10+1
4100 FOR T1=1 TO K1
4110 T2=RND
4120 NEXT T1
4130 NEXT K
4140 REM DISPLAY DICE
4150 F=2
4160 D(3)=0
4170 IF D(1)<>D(2) GOTO 4210
4180 D(3)=D(1)
4190 D(4)=D(1)
4200 F=4
4210 PRINT "DICE:","";
4220 FOR K=1TO 2
4230 IF D(K)>=100 GOTO 4250
4240 PRINT D(K),"";
4250 NEXT K
4260 PRINT
4270 RETURN
4280 REM SUBROUTINE TO EVALUATE MOVES
4290 REM V IS THE VALUE
4300 V=0
4310 REM V2 AND V3 ARE USED IN VALUE FORMULA
4320 V2=3.5
```

```
3060 IF B1(N+K)<>0 GOTO 3090
3070 H(J1)=N+K
3080 B1(N+K)=-1
3090 J1=J1+1
3100 IF J1>F GOTO 3130
3110 N=T(J1-1)
3120 GOTO 2840
3130 IF F2<F GOTO 3230
3140 IF F=1 GOTO 3230
3150 IF F=3 GOTO 3230
3160 REM DON'T EVALUATE THE SAME MOVE TWICE
3170 IF T(1)=T(2) GOTO 3250
3180 IF T(1)+D(1)<>T(2) GOTO 3230
3190 IF H(1)<>0 GOTO 3230
3200 IF T(1)+D(2)>24 GOTO 3230
3210 IF B1(T(1)+D(2))>=2 GOTO 3230
3220 GOTO 3250
3230 REM EVALUATE MOVE
3240 GOSUB 4280
3250 J1=F
3260 N=T(J1)+1
3270 GOSUB 3290
3280 GOTO 2890
3290 REM SUBROUTINE TO RESET BOARD
3300 IF J1>0 GOTO 3320
3310 RETURN
3320 K1=T(J1)
3330 B1(K1)=B1(K1)-1
3340 K=D(J1)
3350 IF K1<>25 GOTO 3370
3360 K1=0
3370 B1(K1+K)=B1(K1+K)+1
3380 IF H(J1)=0 GOTO 3410
3390 B1(K1+K)=B1(K1+K)+1
3400 H(J1)=0
3410 RETURN
3420 IF F2>=F GOTO 3500
3430 IF D(1)=D(2) GOTO 3500
3440 REM DIFFERENT DICE--CHANGE THEIR ORDER
3450 F2=2
3460 K=D(2)
3470 D(2)=D(1)
3480 D(1)=K
3490 GOTO 2410
3500 IF M(9)>-9999999 GOTO 3550
3510 REM COMPUTER CAN'T MOVE WITH ONE DIE
3520 F=F-1
3530 IF F>0 GOTO 2390
3540 GOTO 2500
3550 PRINT,"MY MOVE"
3560 FOR I=1 TO F
3570 K=I*2-1
3580 IF M(K)<>25 GOTO 3620
3590 PRINT "FROM BAR TO ";M(K+1)
3600 B1(25)=B1(25)+1
3610 GOTO 3700
3620 IF M(K+1)<25 GOTO 3670
3630 PRINT "BEAR OFF FROM ";M(K)
3640 K=M(K)
3650 B1(K)=B1(K)+1
3660 GOTO 3750
3670 PRINT "FROM ";M(K);" TO ";M(K+1)
3680 K=M(K)
3690 B1(K)=B1(K)+1
4330 V3=1
4340 REM VALUE FOR BEARING OFF OR COMING IN FROM BAR
4350 FOR K=1 TO F
4360 IF T(K)<>0 GOTO 4380
4370 V=V+40*V3
4380 IF T(K)<>25 GOTO 4400
4390 V=V+4000
4400 NEXT K
4410 REM CHECK FOR RUNNING GAME
4420 IF B1(25)<>0 GOTO 4620
4430 IF B1(26)<>0 GOTO 4620
4440 FOR I=1 TO F
4450 IF H(I)<>0 GOTO 4620
4460 NEXT I
4470 FOR I=24 TO 1 STEP -1
4480 IF B1(I)>0 GOTO 4500
4490 NEXT I
4500 FOR T1=I TO 1 STEP -1
4510 IF B1(T1)<0 GOTO 4620
4520 NEXT T1
4530 REM RUNNING GAME
4540 V2=0
4550 V3=5
4560 REM PENALTY TO GET COMPUTER TO AVOID BACKGAMMON
4570 FOR I=1 TO 6
4580 IF B1(I)>=0 GOTO 4600
4590 V=V-1000*ABS(B1(I))*(7-I)
4600 NEXT I
4610 GOTO 6430
4620 REM NOT RUNNING GAME
4630 REM FILL B WITH BLOTS
4640 C1=0
4650 FOR I=1 TO 24
4660 IF B1(I)<>-1 GOTO 4690
4670 C1=C1+1
4680 B(C1)=I
4690 NEXT I
4700 REM C1 HAS NUMBER OF BLOTS; B HAS LOCATION
4710 REM READY TO GET VALUE OF MOVE
4720 REM T1 HAS # OF POINTS ON COMPUTER'S HOME BOARD
4730 REM T2 HAS # OF BLOTS ON COMPUTER'S HOME BOARD
4740 REM T3 HAS # OF POINTS ON OPPONENT'S HOME BOARD
4750 REM T4 HAS WILLINGNESS TO HIT
4760 REM T5 HAS # OF MEN ON BAR
4770 T1=0
4780 T2=0
4790 T3=.3
4800 T5=0
4810 REM NUMBER OF POINTS IN HOME  BOARD (OR NEAR)
4820 FOR J=17 TO 24
4830 IF B1(J)>-2 GOTO 4880
4840 T1=T1+1
4850 REM ADJUSTMENT FOR POINTS OUTSIDE OF HOME BOARD
4860 IF J>18 GOTO 4880
4870 T1=T1-.3
4880 IF B1(J)<>-1 GOTO 4900
4890 T2=T2+1
4900 REM PENALTY FOR BUILDING PAST 21
4910 IF J<=21 GOTO 4940
4920 IF B1(J)>=0 GOTO 4940
4930 V=V+30*B1(J)
4940 NEXT J
4950 V=V+T1**V2
4960 REM NUMBER OF POINTS ON OR NEAR OPPONENT'S HOME BOARD
```

```
4970 FOR J=1 TO 8
4980 IF B1(J)<2 GOTO 5000
4990 T3=T3+1
5000 NEXT J
5010 REM REWARD FOR PROTECTING OUTSIDE BOARD
5020 FOR J=13 TO 18
5030 IF B1(J)>=0 GOTO 5050
5040 V=V+ABS(B1(J))*V2
5050 NEXT J
5060 T1=T1**V1
5070 T3=T3**V1
5080 REM VALUE OF HIT
5090 FOR J=1 TO F
5100 IF H(J)=0 GOTO 5130
5110 T5=T5+1
5120 V=V+(25-H(J))*T1*11/36
5130 NEXT J
5140 T5=T5+B1(26)
5150 IF T5<4 GOTO 5180
5160 REM SUBTRACT VALUE OF BLOTS THAT CAN BE HIT ON ENTRANCE
5170 V=V-11/36*T2*T3
5180 REM ADDED MOST VALUE TO V
5190 IF F9=1 GOTO 5250
5200 IF C1<=0 GOTO 5250
5210 V=V+300
5220 IF V>=M(9) GOTO 5240
5230 GOTO 6650
5240 V=V-300
5250 FOR J=1 TO 4
5260 IF B1(J)>-1 GOTO 5280
5270 V=V-ABS(B1(J))*T3/V1*(5-J)
5280 NEXT J
5290 REM READY TO FIND OUT ABOUT BLOTS
5300 IF T5>3 GOTO 6130
5310 IF C1=0 GOTO 6130
5320 REM HAVE C1 BLOTS TO EVALUATE
5330 FOR J=1 TO C1
5340 FOR K=B(J)+1 TO 26
5350 C=0
5360 IF K<26 GOTO 5400
5370 FOR K1=1 TO F
5380 IF H(K1)<>0 GOTO 5410
5390 NEXT K1
5400 IF B1(K)<=0 GOTO 6110
5410 REM IF OPPONENT HAS TWO MAN POINT OR COMPUTER IS IN
5420 REM HIS HOME BOARD, OPPONENT WILL BE RELUCTANT TO HIT
5430 REM T4 HAS WILLINGNESS TO HIT
5440 IF K>24 GOTO 5640
5450 T4=1
5460 IF B(J)>6 GOTO 5480
5470 T4=.5
5480 IF B1(K)<>2 GOTO 5650
5490 T4=T4-1
5500 FOR K1=K-1 TO K-6 STEP -1
5510 IF K1<1 GOTO 5600
5520 IF B1(K1)<> -1 GOTO 5540
5530 T4=T4+11+K-K1
5540 NEXT K1
5550 FOR K1=K-7 TO K-11 STEP -1
5560 IF K1<1 GOTO 5600
5570 IF B1(K1)<>-1 GOTO 5590
5580 T4=T4+2
5590 NEXT K1
6240 REM T3 HAS NUMBER OF MEN TRAPPED BY PRIME PLUS 1
6250 FOR J=K TO 24
6260 IF B1(J)<=0 GOTO 6280
6270 T3=T3+B1(J)
6280 NEXT J
6290 V=V+T2*T2*T3
6300 IF B1(K+1)<-1 GOTO 6320
6310 T1=0
6320 NEXT K
6330 REM SPECIAL VALUE FOR BUILDING 5,6,7 AND 18,19,20
6340 L=5
6350 FOR K=L TO L+2
6360 V=V-B1(K)*V2*30
6370 IF B1(K)>-3 GOTO 6390
6380 V=V+B1(K)*V2*30+90
6390 NEXT K
6400 IF L>=18 GOTO 6430
6410 L=18
6420 GOTO 6350
6430 REM GET NUMBER OF POINTS AND NUMBER WITH EXCESS
6440 REM T1 IS # OF POSITIONS COVERED
6450 REM T2 IS # OF POINTS BUILT
6460 REM T3 IS # OF POINTS WITH AT LEAST 3 MEN
6470 REM T4 IS HOW FAR TO MOVE TO GET TO HOME BOARD
6480 T1=0
6490 T2=0
6500 T3=0
6510 T4=0
6520 FOR J=1 TO 24
6530 IF B1(J)>=0 GOTO 6620
6540 T1=T1+1
6550 IF J>=19 GOTO 6570
6560 T4=T4+(19-J)*ABS(B1(J))+(3-INT((J-1)/6))*3*ABS(B1(J))
6570 IF B1(J)>-2 GOTO 6620
6580 T2=T2+1
6590 REM IF 3 MEN ON POINT, REWARD; IF MORE, PENALTY
6600 IF B1(J)>-3 GOTO 6620
6610 T3=T3-(B1(J)*B1(J))+12
6620 NEXT J
6630 T2=T2*V2
6640 V=V+T1+V2*T2+V2*T3-V3*T4
6650 IF F9=0 GOTO 6700
6660 FOR K=1 TO F
6670 PRINT T(K); T(K)+D(K);
6680 NEXT K
6690PRINT "",V
6700 IF V<=M(9) GOTO 6830
6710 FOR J=1 TO F
6720 IF T(J)<>0 GOTO 6760
6730 M((J-1)*2+1)=B0(J)
6740 M(J*2)=28
6750 GOTO 6810
6760 M((J-1)*2+1)=T(J)
6770 IF T(J)=25 GOTO 6800
6780 M(J*2)=T(J)+D(J)
6790 GOTO 6810
6800 M(J*2)=D(J)
6810 NEXT J
6820 M(9)=V
6830 RETURN
6840 REM SUBROUTINE TO BEAR OFF
6850 FOR K=1 TO F
6860 B0(K)=0
```

```
5600 T4=(36-T4)/36*B(J)/12
5610 IF T4>=0 GOTO 5630
5620 T4=.15
5630 IF T4<1 GOTO 5650
5640 T4=1
5650 REM D IS THE DIFFERENCE
5660 D=K-B(J)
5670 IF K<26 GOTO 5690
5680 D=D-1
5690 IF T5>0 GOTO 5910
5700 IF D=1 GOTO 5920
5710 IF D>11 GOTO 5980
5720 REM TO HIT WITH 2 DICE
5730 IF B(J)>13 GOTO 5750
5740 IF B1(26)<>0 GOTO 5920
5750 D1=1
5760 D2=D-D1
5770 IF D2<=6 GOTO 5800
5780 D1=D1+1
5790 GOTO 5760
5800 IF K-D1<=0 GOTO 5840
5810 IF B1(K-D1)<0 GOTO 5840
5820 C=C+2
5830 GOTO 5870
5840 IF K-D2<=0 GOTO 5870
5850 IF B1(K-D2)<0 GOTO 5870
5860 C=C+2
5870 IF D2-D1<=1 GOTO 5910
5880 D1=D1+1
5890 D2=D2-1
5900 GOTO 5800
5910 IF D>6 GOTO 5980
5920 REM CAN HIT WITH ONE DIE
5930 IF B(J)>18 GOTO 5950
5940 IF T5>1 GOTO 5970
5950 C=C+11
5960 GOTO 5980
5970 C=C+1
5980 REM HIT WITH DOUBLES
5990 D2=3
6000 IF INT(D/D2)*D2<>D GOTO 6060
6010 D1=0
6020 D1=D1+D/D2
6030 IF K-D1<1 GOTO 6060
6040 IF B1(K-D1)>1 GOTO 6060
6050 C=C+1
6060 IF D2<>3 GOTO 6090
6070 D2=4
6080 GOTO 6000
6090 REM C HAS ALL WAYS B(J) CAN BE HIT FROM K
6100 V=V-C/36*B(J)*T3*T4
6110 NEXT K
6120 NEXT J
6130 REM CHECK FOR PRIMES
6140 T1=0
6150 T2=0
6160 FOR K=16 TO 23
6170 IF B1(K+1)>-2 GOTO 6190
6180 T1=T1+1
6190 IF T1<T2 GOTO 6300
6200 T2=T1
6210 T3=1
6220 REM T1 IS TEMPORARY COUNTER
6230 REM T2 HAS MAXIMUM LENGTH OF PRIME SO FAR
6870 NEXT K
6880 FOR K=J1 TO F
6890 K1=25-D(K)
6900 IF B1(K1)<0 GOTO 7040
6910 FOR T1=19 TO K1-1
6920 IF B1(T1)<0 GOTO 7310
6930 NEXT T1
6940 FOR K1=25-D(K) TO 24
6950 IF B1(K1)<0 GOTO 7040
6960 NEXT K1
6970 PRINT "I WIN!!!"
6980 SET 1,1
6990 READ :1,C,O
7000 C=C+1
7010 SET 1,1
7020 WRITE :1,C,O
7030 GOTO 7410
7040 BO(K)=K1
7050 T(K)=0
7060 B1(K1)=B1(K1)+1
7070 NEXT K
7080 FOR K=19 TO 24
7090 IF B1(K)<0 GOTO 7120
7100 NEXT K
7110 GOTO 6970
7120 IF B1(26)>0 GOTO 7250
7130 FOR K=19 TO 24
7140 IF B1(K)>0 GOTO 7250
7150 NEXT K
7160 FOR K=1 TO F
7170 IF T(K)>0 GOTO 7250
7180 NEXT K
7190 FOR K=1 TO F
7200 B1(BO(K))=B1(BO(K))-1
7210 M(K*2-1)=BO(K)
7220 M(K*2)=27
7230 NEXT K
7240 GOTO 3550
7250 REM READY TO EVALUATE, SEE IF ALREADY EVALUATED
7260 IF T(1)>0 GOTO 7300
7270 IF T(2)>0 GOTO 7300
7280 IF F2<F GOTO 7300
7290 GOTO 7310
7300 GOSUB 4280
7310 REM SPECIAL RESET--FOR BEARING OFF
7320 FOR K=J1 TO F
7330 IF BO(K)=0 GOTO 7360
7340 K1=BO(K)
7350 B1(K1)=B1(K1)-1
7360 NEXT K
7370 GOTO 2890
7380 REM END GAME
7390 PRINT "I AGREE--YOU ARE IN PRETTY POOR SHAPE!!!"
7400 GOTO 6980
7410 PRINT
7420 PRINT "COMPUTER","CHALLENGERS"
7430 PRINT C,O
7440 PRINT "DO YOU WANT TO PLAY ANOTHER GAME (Y/N)";
7450 INPUT A$
7460 IF A$="N" GOTO 7500
7470 RESTORE
7480 IF A$="Y" GOTO 380
7490 GOTO 7440
7500 END
```

Using PRINT USING

BY DAVID A. LIEN

Of all the various ways we can PRINT, the most powerful (but most confusing) is the one called PRINT USING. The name PRINT USING itself implies that you *PRINT* something *USING* something else. That implication is correct.

As originally developed for use on large computers, PRINT USING consists of two parts — PRINT and USING. PRINT does as the name implies, USING the format (called the "image") found in **another** line. The TRS-80 PRINT USING is similar, but does not always require a second line for the "image" . . .as we will see.

PRINT USING With Numbers

Type:

```
10 A=123.456789
40 U$ = "###.##"
50 PRINT USING U$;A
```

and RUN.

The answer is PRINTed as

```
123.46
```

It was rounded up and PRINTed to an accuracy of 2 decimal places. Add:

```
20 B=1.6
60 PRINT USING U$;B
```

and RUN. The screen shows

```
123.46
  1.60
```

The first thing to note is that we have called upon line 40, our image line, twice — once in line 50 and again in line 60. Next, note that two answers appeared with their decimal points lined up. Last, see that a 0 has been added to the 1.6 to make it read 1.60. These latter two points are important if you're printing out business reports.

One more addition:

```
30 C=9876.54321
70 PRINT USING U$;C
```

Produces:

```
%123.46
   1.60
9876.54
```

error

What gives???

Well, the % sign means we have overrun our image line's capacity to print digits **left** of the decimal point, but it prints them anyway. Better to lose our decimal point lineup than important numbers, but it does call our attention to a programming problem. Let's add another # sign to make room for that extra digit. (We are adding another **element** to the **field** in the **image** line. Got that?)

```
40 U$ = "####.##"
```

and RUN.

That's better — but the overrun message would appear again if we tried to print a number with more than 4 digits on the left.

So far, this PRINT USING business looks like it might have some potential, lining up decimal points like it does. We don't have any other reasonable, straightforward way to accomplish that, and it's essential for printing dollars and cents in business reports. Wonder how we can print a dollar sign?

Let's change our image line to:

```
40 U$ — "$####.##"
```

(count 'em carefully) and RUN. Nice, eh? The dollar signs all line up in a row:

```
$ 123.46
$   1.60
$9876.54
```

But suppose we want the dollar signs to snug right up against each dollar amount? Make 40 read:

```
40 U$ = "$$###.##"
```

and RUN and we get:

```
$123.46
  $1.60
$9876.54
```

not specially attractive in this format, but taken singly, as when writing checks, it's almost essential.

The lessons so far are:

1. PRINT USING with # prints the decimal point at the same place for every size number printed.
2. It rounds off the cents (the numbers to the right of the decimal point) to the number of # signs there. It does not round off dollars (left of the decimal point), but sends up an error flag %, prints all dollars, and slips the decimal point to the right if the field isn't large enough.
3. If a single $ is added to the left, dollar signs will be printed and lined up in a column like decimal points. This single $ does not expand the field.
4. If two $ are placed on the left, one $ will be printed on each line and will be placed immediately in front of the first dollar digit. One of these $ can replace one # in the field, thereby not expanding it.

We've covered a lot with very little program, but have a long way to go.

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Printing Checks

When using a printer for writing checks, it's usually wise to take extra precautions against "alterations". This is easily accomplished by changing line 40 to read:

```
40 U$ = "**###.##"
```

(count 'em) The RUN now reads:

```
**123.46
****1.60
*9876.54
```

That's swell, it fills up the unused spaces all right, but we lost the dollar sign. Okay, we'll expand the image "field" by one space and put in a dollar sign.

```
40 U$ = "**$##.##"
```

(Aren't you glad we have an Editor for all these changes?) See it now:

```
*$123.46
***$1.60
$9876.54
```

just like they do it uptown!

If you want to really impress others with the size numbers you usually deal with at your lemonade stand, add lots more # signs to the image line, thus:

```
40 U$ = "**$###############.##"
```

and your checks read:

```
**********$123.46
**********$1.60
**********$9876.54
```

. . .very impressive. Since we're obviously big time operators, having franchised our lemonade stands, it's getting hard to keep track of the big numbers. How about some commas to break them apart? (Knock out the extra *'s first. Too hard to count them.)

```
40 U$ = "**$,##.##"
```

(look closely) and RUN.

```
**$123.46
****$1.60
$9,876.54
```

Only one of our numbers has more than 3 digits, but a comma separated its 9 and 8 for easier readability. In the image field, the comma can be placed anywhere between the $ and the decimal point, and only **one** comma is required to automatically insert commas to the left of every 3rd digit left of the decimal point.

Stringing it out

Let's rework our resident program to show some other PRINT USING capabilities:

```
1 CLS : PRINT
10 A = 123.456789
20 B = 1.65
30 C = 9876.5432
40 U$ = "#####.##    #####.##    #####.##"
50 PRINT USING U$;A,B,C
90 PRINT : LIST
```

Don't mind lines 1 and 90. They are just handy for clearing the screen, bringing the printout down a space, then LISTing the program for study after it has been printed. I use the technique all the time. You might like it too.

Anyway, RUN it and see how the same numbers can be displayed horizontally instead of vertically. All depends on what you need at a given time.

```
123.46          1.60          9876.54
```

PRINT USING With Strings

Change the program to read:

```
1 CLS : PRINT
10 A$ = "IT'S"
15 B$ = "HOWDY"
20 C$ = "DOODY"
25 D$ = "TIME"
40 U$ = "%%"
50 PRINT USING U$;A$
90 PRINT : LIST
```

and RUN.

The only thing unique about this program is in line 40. As if we didn't already have enough uses for the % sign to worry about, here is another. % is a symbol in TRS-80 PRINT USING which is to strings something like what the # is to numbers. We used two %% so reserved two spaces for strings and only IT was printed. Unlike #, however, to reserve more spaces in the string field, we add blank spaces between the % signs. Change line 40 to

```
40 U$ = "%  %"
```

and RUN. 4 spaces are set aside and IT'S is printed without clipping. Let's make room for printing another string on the same line.

```
40 U$ = "%  %%  %"
50 PRINT USING U$;A$,B$
```

and RUN. Ooops! We ran

```
IT'SHOWDY
```

together. To space them apart we must have to put an actual space in the image field just as we did earlier with printing the numerics.

```
40 U$ = "%  % %  %"
```

and RUN. That's more like it. Now it's your turn. Complete lines 40 and 50 to print IT'S HOWDY DOODY TIME all on one line.

Answer:

```
40 U$ = "%  % %  % %  % %  %"
50 PRINT USING U$;A$,B$,C$,D$
```

It's time to quit doodling around and get down to business too! Let's change our HOWDY DOODY for some typical report headings.

```
1 CLS : PRINT
10 A$ = "PART NUMBER"
15 B$ = "DATE PURCHASED"
20 C$ = "DESCRIPTION"
25 D$ = "COST"
40  (you figure out this one yourself)
50 PRINT USING U$;A$,B$,C$,D$
90 PRINT :LIST
```

Answer: 40 U$ = "% 9 spaces % % % % % % % % %

(Four spaces between the %s where we split line.)

Bring On The Money Changers

Here is a straightforward user program which uses PRINT USING in a practical way. One would be hard pressed to get the same results in so short a program without USING it. If you're not in the international currency business, just type in the first half-dozen or so DATA lines (plus the last one) to get a feel for what PRINT USING can do, and see how # & % can be mixed with blank spaces on the same image line.

```
1 REM  * INTERNATIONAL MONEY CHANGER *
2 REM  * EXCHANGE RATES AS OF AUGUST 1979 *
10 CLS
80 RESTORE : PRINT
100 INPUT"       HOW MANY DOLLARS DO YOU WISH TO EXCHANGE ";D
110 PRINT : PRINT TAB(18);"AT TODAYS RATE YOU WILL GET" : PRINT
400 READ A$,A,B$,B : IF A$="END" THEN 80
460 P$="%                  %  ########.##    %                 %  ########.##"
470 PRINTUSING P$;A$;D/A;B$;D/B
800 C=C+1 : IF C = 11 GOTO 900
850 GOTO 400
900 FOR T=1TO500 : NEXT T : C=0 : PRINT :GOTO400
1000 DATA ARGENTINE PESO,.0007
1010 DATA AUSTRALIAN DOLLAR,1.1295
1020 DATA AUSTRIA SCHILLING, .0751
1030 DATA BELGIAN FRANC, .0342
1040 DATA BOLIVIAN PESO, .095
1050 DATA BRAZIL CRUZEIRO, .375
1060 DATA BRITISH POUND, 2.2360
1070 DATA CANADIAN DOLLAR, .8532
1080 DATA CHILEAN PESO, .0284
1090 DATA COLOMBIAN PESO, .0284
1100 DATA DANISH KRONER, .1902
1110 DATA EGYPTIAN POUND, 1.45
1120 DATA ECUADORIAN SUCRE, .0357
1130 DATA FINNISH MARKKAA, .2622
1140 DATA FRENCH FRANC, .2347
1150 DATA GREEK DRACHMA, .0276
1160 DATA DUTCH GUILDER, .4975
1170 DATA HONG KONG DOLLAR, .1939
1180 DATA INDIAN RUPEE, .1263
1190 DATA INDONESIAN RUPIAH, .0016
1200 DATA IRANIAN RIAL, .01379
1210 DATA IRISH POUND, 2.0650
1220 DATA ISRAEL POUND, .0385
1230 DATA ITALIAN LIRA, .001224
1240 DATA JAPANESE YEN, .004619
1250 DATA JORDIANIAN DINAR, 3.3613
1260 DATA KUWAIT DINAR, 3.6331
1270 DATA LEBANESE POUND, .3082
1280 DATA MEXICAN PESO, .0439
1290 DATA N. ZEALAND DOLLAR, 1.0180
1300 DATA NORWEGIAN KRONER, .1994
1310 DATA PERUVIAN SOL, .004388
1320 DATA PHILIPPINE PESO, .1370
1330 DATA PORTUGAL ESCUDO, .0205
1340 DATA SAUDI ARAB RIYAL, .2976
1350 DATA SINGAPORE DOLLAR, .4660
1360 DATA S. AFRICAN RAND, 1.1928
1370 DATA SPANISH PESETA, .0151
1380 DATA SWEDISH KRONOR, .2374
1390 DATA SWISS FRANC, .6042
1400 DATA TURKISH LIRA, .0212
1410 DATA URAGUAY NEW PESO, .1372
1420 DATA VENEZUELA BOLIVAR, .2330
1430 DATA W. GERMAN MARK, .5468
1500 DATA END,0,END,0
```

All About Level II

Dr. David Lien, the author who opened up the world of microcomputers for many persons with his TRS-80 Level I User's Manual, has scored an even more impressive achievement with his latest work *Learning Level II*.

With the same light, step-by-step approach that made his Level I Manual a model learning tool, Dr. Lien delves into the intricacies and power of Level II that the Radio Shack Reference Manual alludes to but never fully explains.

Learning Level II begins by providing updates needed to make the *Level I Manual* compatible with Level II. In a technique not often seen, Dr. Lien provides duplicate updates in the back of his volume so that you can actually cut the updates from the book and paste them into your *Level I Manual*. You are then guided through the fundamentals and special characteristics of Level II BASIC, with early chapters devoted to the functions and operation of the Editor.

Also covered early in the volume are techniques for chasing "bugs." For many TRS-80 owners, Lien's explanation of the "shift key bug" will be worth the price of the book. He even has a method for finding that particular bug, which, in my experience, is one of the most prevalent in the TRS-80 world and one of the toughest to find if you don't realize what's happening. (See pages 90 and 91 of Lien's book.)

Having explained the uses of the Editor and bug chasing, Dr. Lien moves into the features of Level II and covers the ASCII set, strings, LEN, DEFSTR, CLEAR, DIM, VAL($), STR($), INKEY$, single and double precision numbers, PRINT USING (see the accompanying reprint), intrinsic math functions, the trig functions, multi-dimension arrays and PEEK and POKE.

Not content to rest after all that, Lien also explains dual cassette operation, using the expansion interface with the real-time clock, printers and other peripherals.

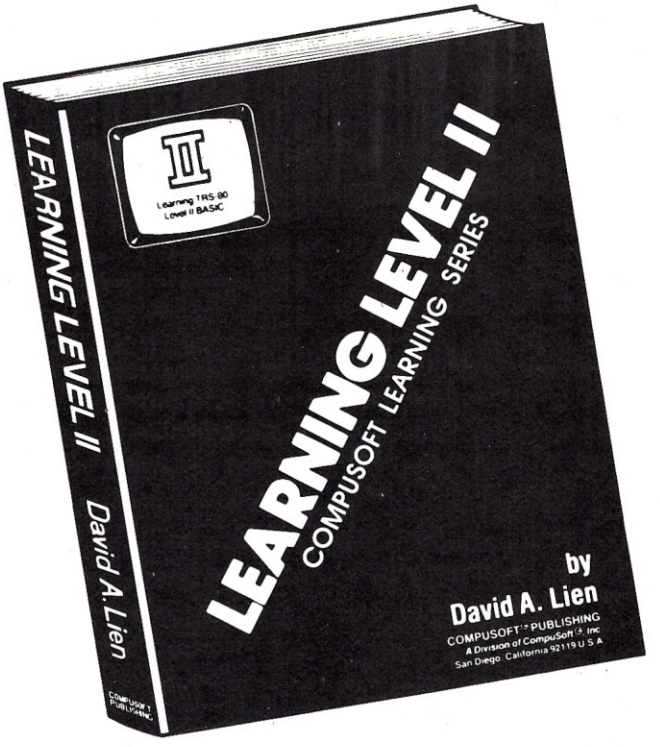
In Appendix A, the Level II error messages are covered with an explanation of what causes each particular error, test programs to generate the errors and sample runs. If the terse explanations in the *Level II Reference Manual* frustrate you, this appendix will be a giant step forward in understanding.

Though written for the TRS-80, *Learning Level II* should benefit other micro owners as well, considering how many personal computers utilize Microsoft BASIC. Though the interpreters may not be identical, there are similarities among all of them.

There is little doubt about the success of Dr. Lien's book as the entire edition was completely sold out before it came off the presses. *Learning Level II* looks to be a runaway best seller in the micro world and may be the most significant microcomputer book in 1980 — unless Dr. Lien's own "Controlling The World With Your TRS-80," and "Learning Disk BASIC and TRSDOS," give it serious competition.

— Ken Mazur

Here's Your 2nd Half...



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CIRCLE 44

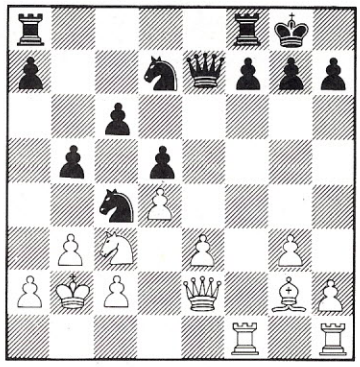
The Tenth North American Computer Chess Championship

BY EVAN H. KATZ

Throughout the last five days of October, 1979, a decade after ACM's first computer-chess contest, another chapter was written in the continuing development of thinking machines. The computer-chess tournament astounded everyone in Detroit. Improvements among the top programs, already considered to have expert capabilities, were minimal. The bottom of the heap, however, formerly fairly weak, demonstrated markedly improved chess abilities in all aspects of the royal game. Almost every board battle was a fight worthy of study and consideration to both programmers and common chess nuts as well. The thrills produced this year should be an encouragement to all those who have waited for trash to be replaced by treasure.

The site, provisions, and accommodations for this year's N.A.C.C.C. were excellent. To begin with, the A.C.M. selected the beautiful Detroit Plaza, in the magnificent Renaissance Center, to host the thousands of men and women who would make the annual pilgrimage to the Conference. The hotel staff worked hard to make the tournament run smoothly — aiding in major telecommunications difficulties and minor problems like keeping participants satisfied with coffee and tea during every round. The tournament room was spacious, well-lit, equipped with an abundance of terminals and communications machinery, and the usual six, large demo boards on an elevated stage.

Tournament rules were similar to those of previous years. A four-round, Swiss-style tournament would be played with 40/2, 10/30 time controls; two time-outs per side, up to twenty minutes each, were permitted per game in case of equipment failure; parameters could *not* be altered during the course of a game except where needed after a failure or in response to a computer's request for info (such as time remaining on either or both clocks); and opponents' point totals would be used to break ties. All regular "human" rules were to be used and the harried tournament director, David Levy, was to have final say in all disputes and where adjudications were necessary after four and one half hours of total play.



Position after Black's 17th move.

Most of the programs at the contest were improved versions of previous tournament appearances. Special acknowledgement should be given to the three micro programs which did extremely well on a whole although sometimes they were unable to overcome the overwhelming size of their opponents.

Pre-game seedings were made by tournament co-ordinators Ben Mittman of Northwestern and Monty Newborn of McGill. Their seedings were based on past performances, updates to the algorithms, and new specifications. The competing computers promptly gave votes of confidence to the two seeding judges by winning, drawing, or losing closely according to their ordering. Accompanying charts to this report list the programs in order of seed, program specs, and names and addresses of the programmers. The friendliness and cooperation of all the participants and organizers was marvelous. You should have no qualms about dropping them a line with your suggestions, comments, or congratulations. They will even answer your questions if such answers require only a reasonable amount of their time.

Each round was an exciting event with six, heated contests. The games between the more advanced participants were played on the center boards and generally produced the most exciting and interesting chess. David Levy contributed his usual interesting and enlightening comments on games in progress and the various strategies that each side should be employing. As opposed to the best human tournaments, the many spectators were able to actively participate by carrying on discussions among themselves and by exchanging loud comments with David on stage. The programmers also conveyed their own ideas as well as their computer printout's predictions and evaluations. The majority of there spectatos were A.C.M. attendees but many others were computer chess fans from all over the country, chess addicts from the Detroit area, and press reporters for magazines, newspapers and television stations. A local Detroit chess club provided able assistants who manned the display boards and then found themselves caught up as much in programming aspects as the chess play.

Saturday afternoon, before the actual computer tournament competition on Sunday, a game was held between David Levy and the team of David Slate and Chess 4.9. The major purpose was to determine if a 2100 human player, using advice and analysis from his 2100

White: David Slate + Chess 4.9 Black: David Levy

1. f4	d5	A good choice, according to David, who points out that he has only faced the Birds a few times throughout his career.
2. Nf3	Nf6	
3. e3	Bg4	Black begins his plan to undermine the white stringpoint, e5, gain the center with initiative, and attack the white king on whichever side it will castle on.
4. b3	Nbd7	Both sides again develop with eyes for e5, black keeping his QP free.
5. Bb2	c6	Black strengthens d5 and prepares to aim his queen at e5 from c7. The move b5, if white plays 0-0-0, is also ready.
6. Be2	B:f3	Now, although black loses the bishop for knight, white has moved his bishop twice, "developing" it (vs. black pawn on d5 and c6) to f3, and has lost one piece to bear on the crucial e5.
7. B:f3	Qc7	
8. Nc3	e5	Black now frees himself, removing the white plus in the center, and is ready to develop the KB and castle.
9. f:e5	N:e5	
10. Qe2	Bd6	Black's piece coordination superiority and white square control are the plus factors here although white is by no means sunk.
11. g3	Qe7	White parries black's screened Q+B threats. Levy, judging that White must castle on the queenside prepares to exchange off the defending bishop.
12. 0-0-0	0-0	The lack of play that white was able to generate in the game might indicate Bg2, and 0-0 as a more tenable, but admittedly less risky, course of action. Levy later said that 12 . . . Ba3 might have been more efficient.
13. Bg2	Ba3	
14. Kb1	B:b2	White's loss of tempo is explainable. 14. Rhf1 strengthens.
15. K:b2	b5	Attack! ! What can white do here?
16. Rdf1	Nfd7	Wrong rook. White must play defense on the queenside as counterattack is not realistic via K-side pawn rolling. Black sends his "bad" knight to where the action is for attack.
17. d4	Nc4+	No human would ever give black such an attack for a measely pawn which the human would intuitively know has to be lost plus grave positional "interest."
18. b:c4	Q:b4	
19. Kc1	Q:c3	Chess 4.9 probably didn't like its positon much, and David Slate simply missed the knight "sack"
20. c:b5	c:b5	
21. B:d5	Nb6	With white's queen pinned down, his two rooks inactive, his bishop to be exchanged, and lines open on his exposed king, what can really be expected? Black never gives white a chance to reconcile and attacks nicely.
22. Bb3	Nc4	
23. B:c4	b:c4	
24. Qe1	Qa3+	White temporarily is able to chase the black queen a bit with the threat of a queen exchange. Not 24 . . . Qa1+, 25 Kd2 Q:a2 26. Qa1 with excellent drawing possibilities for white. Now white has nothing and black's attack will ultimately decide.
25. Kd2	Rab8	Again, white can not stop the black rooks from penetrating.
26. Ke2	Rb2	White knows that the queenside is lost and must be abandoned.
27. Qd2	R:a2	Naturally, not 27 . . . Q:a2, 28. Ra1 winning for white instead.
28.Rb1	Qe7	Black prevents any Rb7, and will now powerfully position his queen on e4.
29. Ra1	Qe4	If 29. Rhf1 then Qe4, 30. Rbc1 and black is at liberty to bring his f rook to bear with a and c pawn pushing at the opportune moments.
30. Rhc1	R:a1	
31. R:a1	Qg2+	
32. Kd1	Qh1+	
33. Qe1	Qb7	Over the past several moves black has been able to further disrupt coordination and invulnerability in the white camp and has to merely tie up the machine's and David's (!) circuitry until everything caves in.
34. Ke2	Rb8	
35. Ra4	Rc8	I'm sure David missed white's move but it matters little now.
36. Ra5	Qe4	
37. R:a7	Q:c2+	White eventually will have to grab the a pawn as black could have pushed it without any worries, although there . . .
38. Qd2	Qe4	
39. Qe1	c3	. . . always is that c pawn about to cause even more annoyance.
40. Kf2	h5	White had to stop Qg2+. Black gets rid of any back rank possibilities and draws the mating net closer around white.
41. Ra5	h4	
42. Ra1	h3	
43. Qh1	Qc2+	
44. Kf3	Rc6	King back lets the c pawn queen, the mate must have been too far for the machine and David is just playing things out.
45. Qb1	Rf6+	
46. Kg4	Qe2+	
47. Kh4	Rh6+	
48. Kg5	Qh5+	
49. Kf4	Rf6+	
50. Ke4	Qf5++	

computer chess wizard, could best Levy. Considering the small improvement in the program over its predecessor, and the fact that David's concentration would be fixed on a single game (without financial considerations as in Toronto), Levy had to be considered at least a "field goal's" favorite. On the other side of the coin were arguments that use of the computer program to perform like a calculator in laborious searching, and the machine-human combination having the white pieces, could force through the point.

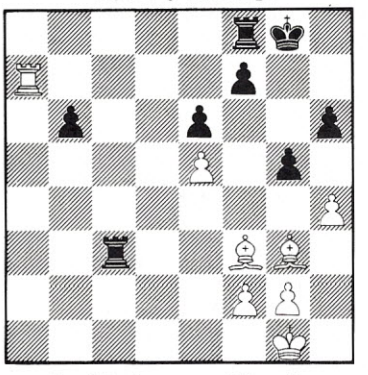
The game itself is presented on the preceding page with my own comments. David won with good style, and rightly so. Positionally, the Northwestern team was unable to match the master. Luckily for those of us who have been scorned for rash predictions of computer chess abilities in the near future, the tree search has been greatly optimized. Most focus is now on positional comprehension, material "compensation" from positional factors, goal direction, and pertinency decision-making in regard to positional factors. Yes, hardware will become faster, especially with chess-specific pieces, and search shortcuts will be found, but it is the global concept of the game that will put the automation on the next plane in its quest for supremacy.

I'm sure you've noticed my unusually large percentage of commentary relating to the game's positional aspects as opposed to the tactical wizardry usually found in chess contests where computers take part. The simple reason is that there were hardly any tactics! Levy masterfully directed the game in the positional direction in which he wanted to go. Although he violated the 11th and 12th commandments for computer chess programs, "thou shalt not exchange bishop for knight," and "thou shalt never give up even a pawn," Chess 4.9 and Slate were unable to coordinate their pieces and put together any semblance of a plan. The two moves wasted are hard to understand. Thus, Levy gave an excellent example on how to defeat a computer . . .today. In a few years — I wouldn't be that sure!

Before the first round began on Sunday morning, a contestants' meeting was held in the tournament hall. The hall was to become a hangout, a local chess joint for the humans themselves, a spot to bring food (mostly of the "munchies" kind) for consumption, and a meeting place occupied throughout the night by sleepless computer chess devotees. The meeting, led by Mittman and Newborn concerned itself with only one main issue and two minor points after the basics (such as pairings and rules), had been approved.

A highly controversial issue that was raised concerned Barend Swets and his program, BS'66'76. Due to unavoidable circumstances, Barend was saddled with a fifty-second communications lag between his computer in Europe and Detroit. This delay, being five times the average, would give BS'66'76 a distinct disadvantage. Barend asked to be given extra time to compensate for the lag. Upon being questioned directly as to the amount, he clarified his request to thirty seconds per move. The arguments on both sides were forthright — "fairness" to Barend vs. setting a precedent for personal allowances.

The Levy Challenge



Can Black move and draw?

Levy, as tournament director, finally agreed to decide the matter with the advice of the participants. A vote was taken and five out of the nine teams represented at the meeting elected not to give time allowance to the program. Since David was leery of the idea to begin with, the final decision was that no time allowances would be made. Hence, BS'66'76 played, throughout the tournament, at an average, internal rate of one minute less per move.

After considering the matter and the opinions expressed, I have to agree with the decision rendered. Although the tournament organizers have been, and are, extremely cooperative during and between A.C.M.'s, they simply can not be expected to make personal allowances when it comes to the actual competition. If it were possible to compute and compete at 40/2 real computer time, and all the programs would play as such, o.k.. But this can not be done for practical purposes and, therefore, the machines play at 40/2 actual time. Barend probably holds the record for encountering hardware problems in the many tournaments he's joined.

One seemingly innocent situation was the use of electronic computer chess clocks run by the programs themselves. Because of possible power shortages, however, a backup, manual clock was recommended. One interesting and useful device seen was the Micromate 180 computerized chess clock. Not only does it have rechargable batteries but it is programmable for many types of chess time controls, some of which are not possible with a regular clock. It gives exact time remaining, has a warning beeper, automatically goes into the next time control, keeps track of the number of moves made, allows handicapping, and is fully adjustable during the game. Quite a nice gadget!

On a similar note, Kathe Spracklen commented that it would be impossibe to give SARGON all the necessary information about its game if power were to be lost, and that the other micros would have similar tremendous problems. Everyone agreed to watch the vital power cords, which the hotel had nicely taped out of the way. As a matter of fact, only one partial loss was suffered throughout the competition, (and not to a micro, either.)

The first round got under way, slightly delayed by the meeting, around 1 p.m. as planned. In a Swiss-style tournament, the upper half is pitted against the bottom. This means the first seed plays the seventh seed and the sixth seed plays the twelfth seed in all N.A.C.C.C.s. The programs were up (although some of the programmers weren't, having arrived late the night before), electricity and communications were flowing, and a fair turnout of people settled down to see this new chapter in computer chess competition.

The luck of the draw gave Belle and the other odd seeded players the black pieces in round one. L'Excentrique got the better of a 6. Qe2 open Ruy Lopez due to a spacial advantage and Belle's queen being cornered in on b6. but then white got involved in some loosening pawn pushes on the wings and, after queens were removed in an advantageous position, black had a better endgame due to a strong bishop pair and white's pawn overextension. Belle then mounted pressure and gained the only open file (Q). White was forced into accepting doubled and isolated king pawns while giving black a passed queen pawn with bishops on the same black squares. With white's pieces tied

down, black was able to effectively use his king in winning white's last center pawn and threatening white's queenside pawn while at the same time threatening to queen a pawn for the decisive threat. White resigned at move 66 after being forced to drop a rook and his kingside pawns. All and all, L'Excentrique really didn't give the defending champ much of a problem.

In another first round game, Chess 4.9, with white, mated Ostrich in a quick thirty-five moves. The game went into the Panov attack in the Caro-Kahn, always an exciting opening. But instead of equalizing via symmetry, Ostrich made a recapture with his queen and lost an important tempo with 6. Qd8. It obviously liked giving white an isolated pawn, and not getting one itself, more than the tempo loss. But white allowed a disruption of its queenside and had to settle for the bishop pair including a basically immobile black queen bishop locked in by the earlier queen recapture. On move 20, Chess 4.9 was able to force the win of two pieces for a rook knowing that this was correct even though Ostrich would gain a passed b pawn. Black's blunder on move 26 gave white a decisive edge. Four moves later Ostrich again suffered an electronic hiccup and let white enjoy pulling off a mate in five, right then and there.

David Levy performed superbly as annotator and commentor on all six games, walking back and forth for hours. Always correct, always astute and always interesting, he was, nevertheless, "challenged" in the very first round. In the Chess 4.9 vs. Ostrich position, shown above, David claimed he could draw with the black pieces. Called upon to prove it by the Chess 4.9 team, and with a token $1.00 bet wagered with Dave Slate, Levy sat down to play the position at speed rate with 4.9 after the game with Ostrich had ended. He lost. It's an interesting question and comments from readers would be welcome. Considering that f4 will unleash the white bishop and that black only has a single rook to work with, possibily in connection with pushing the b pawn, white should be able to win if players or computers on both sides are of approximately equal strengths.

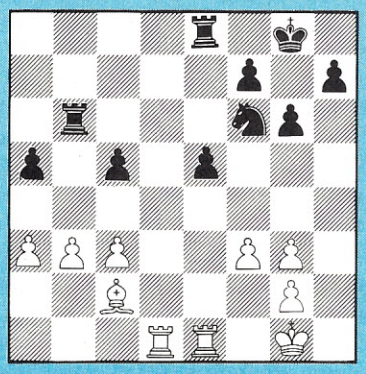
Awit did not open its game with Duchess too well. It executed an unheard-of retreat on move five, and then played altogether too passively in letting Duchess build an unconquerable queenside position around the gambit pawn which it accepted for free. Duchess' material advantage gained near the end, became decisive, and, after Awit was forced to lose the knight and a few pawns, around the 40th move, Awit resigned.

For poor Rufus playing black, this was just not going to be a good tournament. In its game against Chaos, it neglected to reinforce its stonewall and soon suffered the consequences of a weak, backward e pawn and a powerful white knight at e5 which could not be easily removed. With white making the most of the open a and c files, and making black's bishop's life miserable, black didn't have much. The moment of truth came after white mounted pressure on a6 with a knight transfer to c5, and then broke things open by the 25th move. After Rufus was through horizoning, Chaos mated it on the 36th move without much problem.

Surely, the outstanding micro game of the tournament was Sargon 3 vs. Mychess. Mychess proved to be close to its opponent in caliber although Sargon did demonstrate its overall, but moderate, superiority. Sargon's opening book was specifically positional in order to avoid tactical battles with machines that were seeing ahead sev-

White: SARGON 3 Black: MYCHESS

1.	d4	d5
2.	Nf3	Nf6
3.	e3	e6
4.	Bd3	Nc6
5.	0-0	Bd6
6.	Nc3	a6
7.	Bd2	b6
8.	a3	Bb7
9.	Re1	a5
10.	e4	d:e4
11.	N:e4	Be7
12.	c3	N:e4
13.	B:e4	0-0
14.	Qb1	g6
15.	Ne5	N:e5
16.	B:b7	Rb8
17.	Bh6	Re8
18.	Be4	Ng4
19.	Bf4	Bd6
20.	Bg3	c5
21.	d:c5	B:g3
22.	h:g3	Qd2
23.	Qc2	Q:c2
24.	B:c2	b:c5
25.	b3	e5



After Black's 27th move.

26.	f3	Nf6
27.	Rad1	Rb6
28.	Kf2	h5
29.	Ke3	g5
30.	Kd3	Rd8+
31.	Kc4	R:d1
32.	R:d1	Rb8
33.	Rd6	Kg7
34.	Ra6	Rd8
35.	R:a5	Nd5
36.	Be4	Ne3+
37.	K:c5	Rb8
38.	b4	Rc8+
39.	Bc6	Kf6
40.	Ra7	N:g2
41.	Rd7	Ne3
42.	b5	Nc2
43.	a4	h4
44.	g:h4	g:h4
45.	Kd5	Rb8
46.	Rd6+	Kf5
47.	Bd7+	Kg5
48.	K:e5	Ra8
49.	f4+	Kh5
50.	Bc6	Rg8
51.	Bf3+	Rg4
52.	Rd8	Kh6
53.	B:g4	Kg7
54.	Rd7	Ne3
55.	Be6	Kf8
56.	R:f7+	Kg8
57.	Kf6	Kh8
58.	Kg6	Kg8
59.	Rf6+	Kh8
60.	Rf8++	

eral more plies above Sargon's average five ply in the middle game. With white it played the Torre, and with black, the Pirc. Here, after a quiet beginning, Mychess wasted a few moves on the queenside and, with 10. e4, Sargon gained advantage. Sargon's 14. Bb1 was probably caused by a combination of queen restriction and points for attacking the black h pawn. Sargon then proceeding to pick up the bishop pair with 16. B:b7 as it prefers the bishop slightly over the knight. But after 25. b3, all white had left were two weak black queenside pawns. After grabbing the queen file with 27. Rad1, Sargon then found the winning sequence with 28. Kf2, 29. Ke3, 30. Kd3, 31. Kc4, and completely wiped Mychess out to win the game. No, Sargon was not looking far enough ahead to see the downfall of black's queenside, but it intuitively saw, using long range planning techniques, that a king trip was called for.

Unfortunately, even though there was no sub 1400 chess play, there were two forfeits by BS'66'76 in the first and second rounds. Although the exact reasons are still unclear, it seems the operators in the Netherlands didn't quite have the system and program operation down pat and, even after lengthy telephone conversations with Barend, they couldn't get the machine up and cooking for that round. Had any participant withdrawn, Cube 1.1 would have taken its place, followed by Socrates and BB-2, in that order.

And where is computer chess going, people ask? Based on my latest experience I offer the following thoughts:

There is still great room for improvement in the field both on large scale and micro levels. Hardware and searching has been greatly optimized. I'm sure there will be further speed gains in these areas, deepening how far a machine looks ahead and therefore strengthening its game. But this is not where the bulk of the effort should be devoted. The major area still in its infancy is the evaluaiton and understanding aspects of chess. All the machines still play most of the game in tiny stages, whether 5 or 9 ply in thickness, and there is very little goal oriented, long-range work being done by the program.

When a human of any caliber comprehends a position he naturally understands where it will lead many moves from now as well as what will occur in the immediate future. Therefore chess program innovations in both areas, immediate understanding and projection into the future, must be combined to produce a program of master caliber. The matter of weighing all the factors in any given chess position in regard to future considerations is extremely complex and unclear. Such a delicate line the grandmaster must tread millions of times a game deciding his priorities and constructing sequences of plans and backup plans. Abstract concepts such as "it's counterattack at all costs or perish," "a sacrifice now assures victory (although twenty moves away," and "if I do this my 'strong' center will be subject to attack and will eventually become a weakness," are only some of the rudimentary planes which humans have had conquered for many years and which are yet still very cloudy in the world of computer chess where everything is black and white, "0" or "1."

As for ratings and dates, things are slightly more clear for the small machine but still quite vague for the large computer. With the advancements made by Dan and Kathe Spracklen in their series of Sargon programs, going from 1200 to 1400 to 1700, and considering the success of people like Dave Kittienger and Charlie Sullivan, both relative newcomers to the field, I predict that within five years there will be a computer playing at the 2000 level for sure. In the hardware area, there is already a commercially available micro-processor that is more than 50% faster than the ones being used at this year's A.C.M. Combined with improvements in the tree search and pruning (admittedly very hard at this stage), and more intelligent use of the opponent's time, the sixth, and final ply may be conquerable in a few years. The Spracklens have started pioneering work in the area of intelligent chess because of ply limitations. They expect to develop enough along the lines of evaluating types of position that now exist and how they should be treated on the whole. Also in the Spracklen's research are long-range planning to see into the future without concrete analysis, positional factors sometimes being equal or more important than material, and "simple" chess knowledge so as to conquer the 2000 barrier within five years.

By that time, similar type innovations on a large computer should be able to produce the first computer master. Because competition is so fierce and so smart at that level, however, this prediction is very speculative but I believe it is based on more concrete evidence and actual achievements than hypotheses of the past. I look forward, with great anticipation, to the enlightenment that will push the machines' conceptual understanding into another plateau, the way mini-max and alpha-beta did for the tree searching of concrete, exact possibilities.

(Future issues of *Personal Computing* will show some of the games mentioned above, as well as some of the games in the other rounds. Also in our upcoming issue will be David Slate's strong arguments in favor of computer participation in human chess tournaments. And also upcoming is a listing of ICCA's new statutes designed to make that organization an effective and efficient group.)

List of Programmers competing in 10th ACM Tournament

1. "Belle," Ken Thompson, Joe Condon, Bell Telephone Laboratories, RM. 2C423, Murray Hill, New Jersey 07974
2. "Chess 4.9," David Slate, Larry Atkin, Vogelback Com puting Center, 2129 Sheridan Rd., Evanston, Illinois 60201
3. "Duchess," Tom Truscott, Bruce Wright, Eric Jensen, Computer Science Dept., Duke Univ., Durham, N.C. 27706)
4. "Chaos," Mike Alexander, Fred Swartz, John O'Keefe, Victor Berman, Computing Center, University of Michigan, 1075 Beal Avenue, Ann Arbor, Michigan 48109
5. "Blitz 6.9," Bob Hyatt, Albert Gower, Box 8286, Southern Station, Hattiesburg, Mississippi 39401)
6. "Sargon 3," Dan and Kathe Spracklen, 10832 Macouba Place, San Diego, California 92124
7. "L'Excentrique," Claude Jarry, 12385 Jeanne Mance, Mont., Quebec
8. "Ostrich 80," Monroe Newborn, School of Computer Science, McGill University, Montreal, Quebec, Canada H3A 2K6
9. "Awit," Tony Marsland, Dept. of Computing Science, Univ. of Alberta, Edmonton, Alberta T6G 2H1
10. "Rufus," Charles Sullivan Jr., 1026 Delaware St., Fairfield, CA 94533
11. "BS'66'76," Barend Swets, Oude Delft 95, Delft, the Netherlands
12. "Mychess," Dave Kittinger, 2431 Lyvona Lane, Anchorage AK 99502

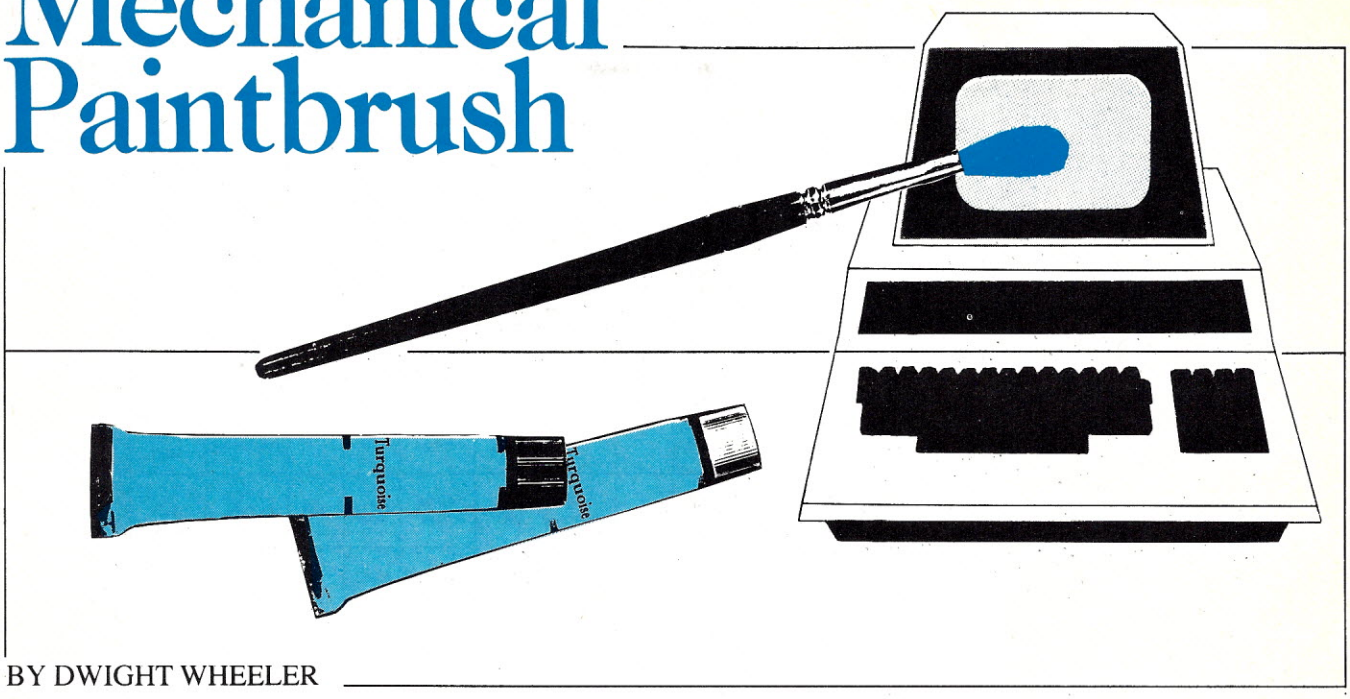
SPECIFICATIONS OF PROGRAMS

PROGRAM (NAME)	COMPUTER (NAME)	WORD SZ. (# BITS)	SPEED (INST./SEC.)	AGE (YEARS)	LANGUAGE (NAME)	SIZE (PROG./TREE)	SEARCH (TYPE)	POSITIONS (/MOVE)	OPEN. BOOK (# POS.)	MISC. 1	MISC. 2
BELLE	PDP 11	16	800,000	10	C and Assem.	16K 1K	Alpha Beta	1,080,000	200,000	Move Gener. Hardware	Endgame Data-Bases
CHESS 4.9	CDC Cyber 176	60	14,000,000	11	Assem-bly	8K> 20,000	Alpha Beta	648,000	7,000	Has Won 7/9 ACM's	U.S.C.F. Rated 2040
DUCHESS	IBM 370/165	32	3,000,000	6	Assem-bly	50K 1000K	Alpha Beta	144,000	3,000	Beat Kaissa In 1977	U.S.C.F. About 1900
CHAOS	Amdahl V/6	32	7,000,000	7	Fortran	700K 11,500K	"Human" Select.	54,000	7,500	Four Man Team	75% In 7 ACM's
BLITZ 6.9	Univac 1100/80	36	3,000,000	4	Fortran	20K 200K	Alpha Beta	162,000	3,000	Always Improving	U.S.C.F. About 1800
SARGON 3	Sargon Board	8	600,000	2	6502 Assem.	8K 2K	Alpha Beta	16,000	600	Micro Chess Champ	U.S.C.F. About 1650
L'EXCEN-TRIQUE	Amdahl V/7	32	10,000,000	4	Assem-bly	10K 8K	Alpha Beta	1,080,000	10,000	Revised Often	U.S.C.F. About 1600
OSTRICH 80	Data General	16	800,000	8	Assem-bly	12K 12K	Alpha Beta	25,000	6,000	"Buries Its Head"	U.S.C.F. About 1550
AWIT	Amdahl V/7	32	10,000,000	11	Algol W	6K (Both)	Highly Select.	250	10,000	5-14-0 At 5 ACM's	Shortest Program
RUFUS	Apple II (Micro)	8	200,000	1	6502 Assem.	11K 1K	Alpha Beta	90,000	About 1,000	Only Material Tree	Modelled To Chess 4.7
BS '66'76	IBM 370/168	32	4,500,000	13	Fortran	300K 3000K	Highly Select.	540	3,000	7/18 Recent Record	Doctoral Thesis
MYCHESS	Cromenco Z-2D	8	600,000	2	Z-80 Assem.	19K ≈ 2K	Alpha Beta	16,200	3,000	One Of Larger Programs	U.S.C.F. About 1550

THE TENTH A.C.M. NORTH AMERICAN COMPUTER CHESS CHAMPIONSHIP
OCTOBER 28-30, 1979 SCORECARD DETROIT, MICHIGAN, U.S.A.

PROGRAM	ROUND 1		ROUND 2		ROUND 3		ROUND 4		TOTAL POINTS	TIE BREAKER POINTS	FINAL PLACE
1. CHESS 4.9	W 9	1	B 8	2	W 3	3	B 2	3½	3½	9	1
2. BELLE	B 5	1	W 4	1½	B 7	2½	W 1	3	3	10	2
3. DUCHESS	B 10	1	W 7	2	B 1	2	W 4	3	3	9	3
4. CHAOS	W 12	1	B 2	1½	W 8	2½	B 3	2½	2½	7½	4
5. L'EXCENTRIQUE	W 2	0	B 12	1	W 9	2	B 6	2½	2½	7	5
6. MYCHESS	B 7	0	W 10	1	B 11	2	W 5	2½	2½	6½	6
7. SARGON 3	W 6	1	B 3	1	W 2	1	B 8	1½	1½	10	7
8. BLITZ 6.9	B 11	1	W 9	1	B 4	1	W 7	1½	1½	8½ (32)	8
9. OSTRICH 80	B 1	0	W 11	1	B 5	1	W 10	1½	1½	8½ (28½)	9
10. AWIT	W 3	0	B 6	0	W 12	1	B 9	1½	1½	7	10
11. BS'66'76	W 8	0	B 9	0	W 6	0	B 12	1	1	5½	11
12. RUFUS	B 4	0	W 5	0	B 10	0	W 11	0	0	7½	12

Mechanical Paintbrush



BY DWIGHT WHEELER

I'm a real pet lover at heart — three dogs, two cats, a rabbit and a 8K Commodore. Sometimes it's difficult to give them all the time they deserve, but the Pet is patient and not too demanding. Generally in the evening after supper, when the "live" ones are napping down in the den, the Pet gets the attention.

The other night, my 13-year-old son beat me to the keyboard and was "drawing" a picture on the screen using the Pet's excellent graphic capabilities. He was patiently moving the cursor around and hunt-and-pecking in the characters. The process was very time consuming, since each character required one or two cursor moves before he could put the graphic character where he wanted it. I decided there must be an easier method and began experimenting.

Eventually I came up with the Mechanical Paintbrush program. The core of the program, the GET command, is a real-time function in Pet BASIC which performs much the same as INPUT except it picks up a single character from the keyboard and acts immediately without your striking the RETURN key. In fact, the command acts so fast (60 times a second) that you must create a loop to allow the operator enough time to push one of the keys. Otherwise, GET will return a null and proceed to the next statement.

Typically, you can write the code like this:

```
100 GET A$
110 If A$ = "U" THEN 130
```

Program Listing

```
5    PRINT "CLR"
10   PRINT SPC(7);"MECHANICAL PAINTBRUSH": PRINT : PRINT
20   PRINT "WHAT CHARACTER SHOULD WE USE";
30   INPUT B$
40   PRINT : PRINT "STARTING AT THE CENTER, THE CURSOR"
41   PRINT "WILL TRACE YOUR PICTURE FROM YOUR"
42   PRINT "DIRECTIONS: " : PRINT
43   PRINT SPC(10); "U = UP"
44   PRINT SPC(10); "D = DOWN"
45   PRINT SPC(10); "L = LEFT"
46   PRINT SPC(10); "R = RIGHT"
47   PRINT SPC(10); "E = ERASE"
48   PRINT SPC(10); "P = PRINT"
49   PRINT SPC(10); "C = CHANGE CHARACTER"
50   PRINT : PRINT "READY TO START?" ;
51   GET Q$
52   IF Q$ = "Y" THEN 90
60   IF Q$ = "N" THEN 999
70   GOTO 51
90   PRINT "CLR"; SPC(19); "↓↓↓↓↓↓↓↓↓↓↓↓"; B$
100  GET A$
110  IF A$ = "U" THEN 160
120  IF A$ = "D" THEN 180
130  IF A$ = "L" THEN 200
140  IF A$ = "R" THEN 220
141  IF A$ = "E" THEN 250
142  IF A$ = "C" THEN 2000
150  GOTO 100
160  PRINT "← ↑"; B$;
170  GOTO 100
180  PRINT "← ↓"; B$;
190  GOTO 100
200  PRINT " ←← "; B$;
210  GOTO 100
220  PRINT B$;
230  GOTO 100
250  PRINT " ← space";
260  GET E$
270  IF E$ = "P" THEN PRINT "←"; B$; : GOTO 100
280  IF E$ = "U" THEN 330
290  IF E$ = "D" THEN 350
300  IF E$ = "L" THEN 370
310  IF E$ = "R" THEN 390
312  IF E$ = "C" THEN 2000
320  GOTO 260
330  PRINT "← ↑ space";
340  GOTO 260
350  PRINT "← ↓ space";
360  GOTO 260
370  PRINT "← ← space";
380  GOTO 260
390  PRINT "space";
400  GOTO 260
999  PRINT : PRINT : PRINT "NOT AN ARTIST?...TOO BAD."
1000 END
2000 GET B$
2010 IFB$ <> "" THEN PRINT "←"; B$; : GOTO 100
2020 GOTO 2000
```

```
120 GO TO 100
130 etc.
```

Line 120 will keep the loop going until a "U" is pressed on the keyboard. As soon as a "U" is detected, control will jump to line 130 and the program will continue.

If I may digress for a moment, I should mention that we could use a numeric variable like this:

```
100 GET A
110 ON A GO TO 130, 150, 170
      etc.
120 GO TO 100
130 etc.
```

This is OK if you're looking for a number from 1 to 9. But, if the operator should happen to hit a letter or some other keyboard symbol, the Pet will return an error statement. Here, it would ruin the picture. If you have some other application for the GET statement and wish to use a numeric unit, I suggest using a string variable (which is very forgiving) and incorporate a VAL function to protect you from such accidents. For example:

```
100 GET A$
110 ON VAL(A$) GO TO 130,
      150, 170 etc.
120 GO TO 100
etc.
```

The VAL places a value of zero on any letters or extraneous characters and returns only a numeric figure. (As you know, the ON/GO TO statement is a shorthand way of listing several IF/THEN statements. If A = 1 in the ON statement, then control moves to the first line number; if A = 2, control moves to the second line number listed, etc.)

Our Paintbrush program permits a variety of choices:

U for Up
D for Down
R for Right
L for Left
E for Erase
P for Print
C for Change character

From the lineup of IF statements (lines 110 to 142) the keyboard artist sets in motion the appropriate mini-program to move the cursor, print the character and return to the top for another GET.

"U" moves the cursor up one line and back one space, placing the cursor immediately above the last character, and then prints the character. "D", "L" and "R" do the same in the other directions. (If you really feel the need, you could incorporate other letters or numbers for diagonal movements as well. But don't forget that GET returns only a single character at a time, so you'll have to make some arbitrary definitions for "up to the right, diagonally" and "down to the left". (Maybe W, X, Y and Z or 1, 2, 3, 4.)

"E", which allows you to "erase" any imperfections or unwanted characters, moves the cursor back one position and prints a "space" character. To return to a visible character, just press "P" for Print and the print character will reappear. When using the "erase" function, you can easily lose track of the position of the cursor since you are moving an invisible space around. If you press "P" the visible character will pop back into view.

My first program used only four directions and erase. But after trying the program on a couple of friends, I decided it would be nice if I could change the character being printed. This addition gives your computer art a third dimension. When you GET a "C" the program goes to line 2000 and the next key depressed becomes the new print character. *(Caution:* Don't use " since the computer will see this as a PRINT command and you will get unwanted reverse field representations on the screen.

In line 2010, if nothing has been keyed in, B$ will equal a "null" so control will pass down to line 2020. Two quotation marks, side-by-side, are equivalent to a null. As soon as a character is keyed in, B$ is not equal to a null and therefore control passes along line 2010 to PRINT the new character and then back to line 100.

SPC is similar to TAB, except where TAB prints in specific columns, SPC merely skips spaces. In this program, TAB could be used instead of SPC with the same results.

The arrows indicate the cursor movement keys on the PET. *CLR* and *space* are those specific keys.

This program has provided hours of fun for my family and the other computer bugs at work. But what it really lacks is a method of saving the completed pictures. We've experimented with cassette files but without much success.

[Readers who find an answer to this problem are encouraged to send their solutions to *Personal Computing*'s Feedback section, 1050 Commonwealth Ave., Boston, MA 02215. We'll publish the most useful and interesting responses. — *ed.*] □

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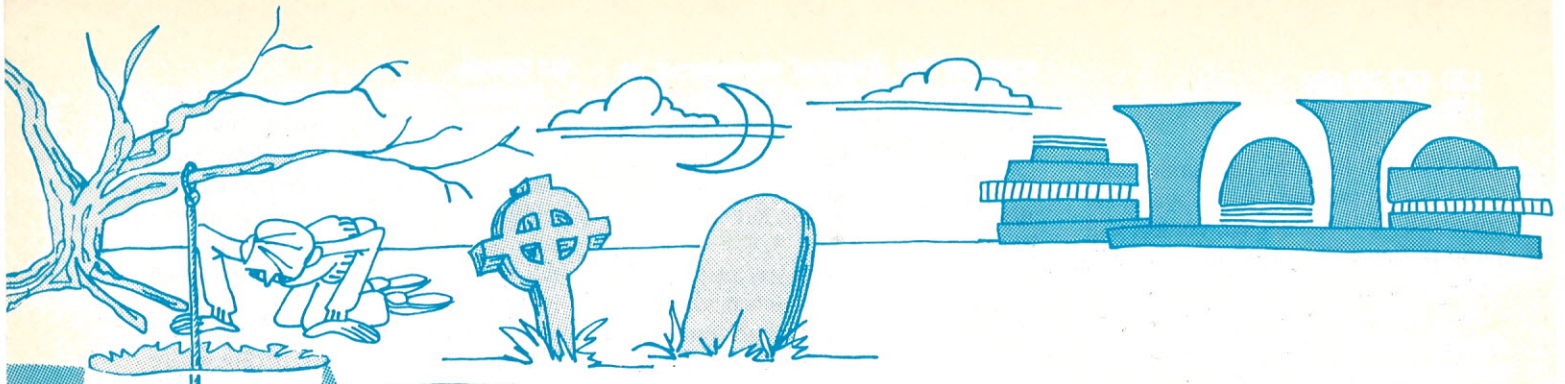
CIRCLE 15



It stood at the bottom of a deep chasm. Cool air sliding down the sides of the crevasse hit waves of heat rising from a stream of bubbling lava and formed a mist over the sluggish flow. Through the swirling clouds I caught glimpses of two ledges high above me: one was bricked, the other appeared to lead to the throne room I had been seeking.

A blast of fresh air cleared the mist near my feet and like a single gravestone a broken sign appeared momentarily. A dull gleam of gold showed at the base of the sign before being swallowed up by the fog again. From the distance came the angry buzz of the killer bees. Could I avoid their lethal stings as I had managed to escape the wrath of the dragon? Reading the sign might give me a clue to the dangers of this pit.

I approached the sign slowly.

And so it goes, hour after hour, as you guide your microcomputer through the Adventures of Scott Adams in an effort to amass treasures within the worlds of his imagination.

By definition, an adventure is a dangerous or risky undertaking; a novel, exciting, or otherwise remarkable event or experience. On your personal computer, Adventure is that and more.

Playing any of the Adventure series consists of three elements: you, the user; the games themselves; and the author, Scott Adams of Orlando, Florida.

For the user, playing Adventure is a dangerous or risky undertaking in that you better be prepared to spend many addictive hours at the keyboard. If you like challenges, surprises, humor and being transported to other worlds, these are the games for you. If you dislike being forced to use your common sense and imagination, or you frustrate easily, try them anyway.

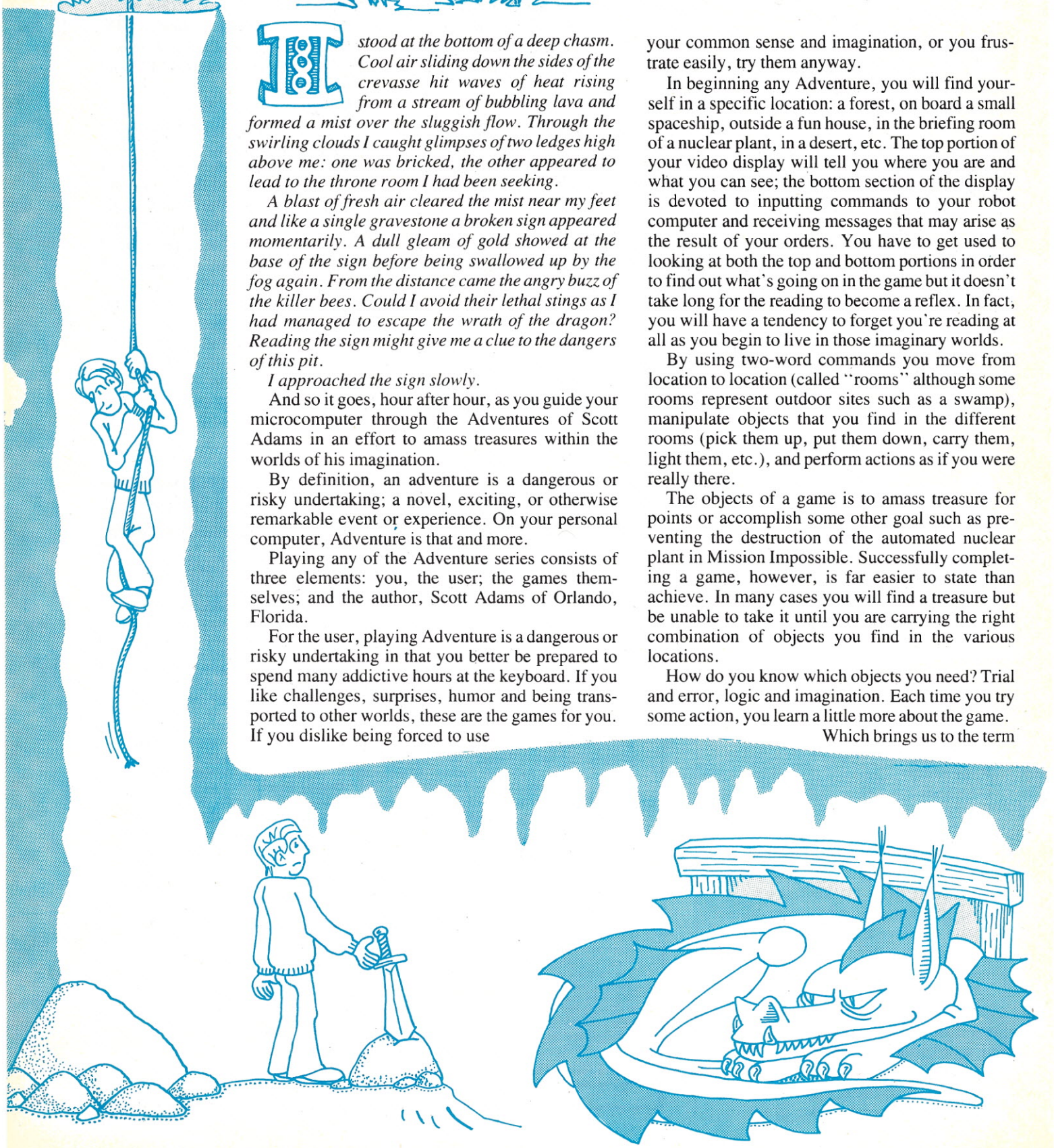
In beginning any Adventure, you will find yourself in a specific location: a forest, on board a small spaceship, outside a fun house, in the briefing room of a nuclear plant, in a desert, etc. The top portion of your video display will tell you where you are and what you can see; the bottom section of the display is devoted to inputting commands to your robot computer and receiving messages that may arise as the result of your orders. You have to get used to looking at both the top and bottom portions in order to find out what's going on in the game but it doesn't take long for the reading to become a reflex. In fact, you will have a tendency to forget you're reading at all as you begin to live in those imaginary worlds.

By using two-word commands you move from location to location (called "rooms" although some rooms represent outdoor sites such as a swamp), manipulate objects that you find in the different rooms (pick them up, put them down, carry them, light them, etc.), and perform actions as if you were really there.

The objects of a game is to amass treasure for points or accomplish some other goal such as preventing the destruction of the automated nuclear plant in Mission Impossible. Successfully completing a game, however, is far easier to state than achieve. In many cases you will find a treasure but be unable to take it until you are carrying the right combination of objects you find in the various locations.

How do you know which objects you need? Trial and error, logic and imagination. Each time you try some action, you learn a little more about the game.

Which brings us to the term



Illustrations by Jack Rudolph

The Adventures of Scott Adams

BY KEN MAZUR

"game" again. While called games, Adventures are actually puzzles because you have to discover which way the pieces (actions, manipulations, use of magic words, etc.) fit together in order to gather your treasures or accomplish the mission. Like a puzzle, there are a number of ways to fit the pieces together; players who have found and stored all the treasures (there are 13) of Adventure #1 may have done so in different ways.

In finding how the pieces fit, you will be forced to deal with unexpected events, apparent dead ends and Scott's humor, which is one of the best parts of the puzzles. (For an example of his cleverness, read the advertisement next to the bottomless hole.)

If you run into a barrier like not being able to discover more rooms, don't give up. Play the game with some friends; sometimes they'll think of things you haven't tried.

Adam's series is based on a program developed by Will Crowther and Don Woods of Stanford on large computer systems. But in creating his own Adventures, Scott has done a service to the microcomputer world; he has taken this fascinating game from the inner sanctums of large computer installations, improved it, and brought it into your home. As a bonus, the micro versions are generally more interesting and more challenging than the parent game.

On a technical level, the Adventure games consist of three parts: the interpreter, the data base and the editor. The editor is used in creating data bases (scenarios) which are then implemented by the interpreter. While the nine currently available games operate in the same manner, the scenarios differ so much that each Adventure is distinct and challenging in its own right.

Scott took two and a half weeks to develop the first game with the other scenarios taking from a week to a month to write. One, Pyramid of Doom, took Adams and his close friend, Alvin Files, nearly seven months to create.

Ideas for the scenarios come from many places, Scott said. Some grow the way they want and others are forced on him as was the development of Mystery Fun House which was conceived by his wife, Alexis, who evidently has a good imagination herself. (It's tough to get past the bouncer in the fun house.) Scott's personal favorite is The Count.

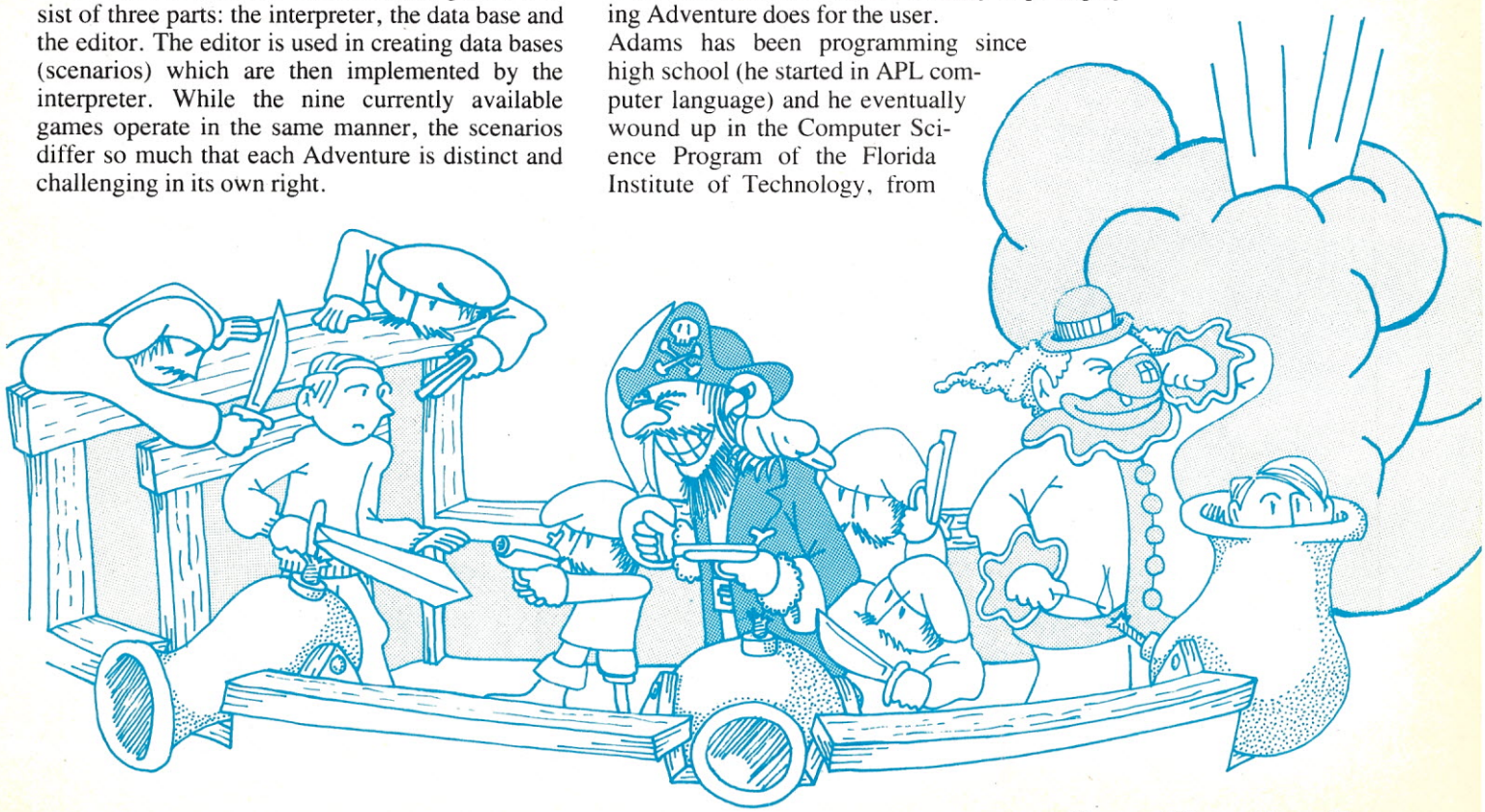
In addition to the games now available, Adams is working on others. Two under development include one set in the Old West while the other is an undersea adventure.

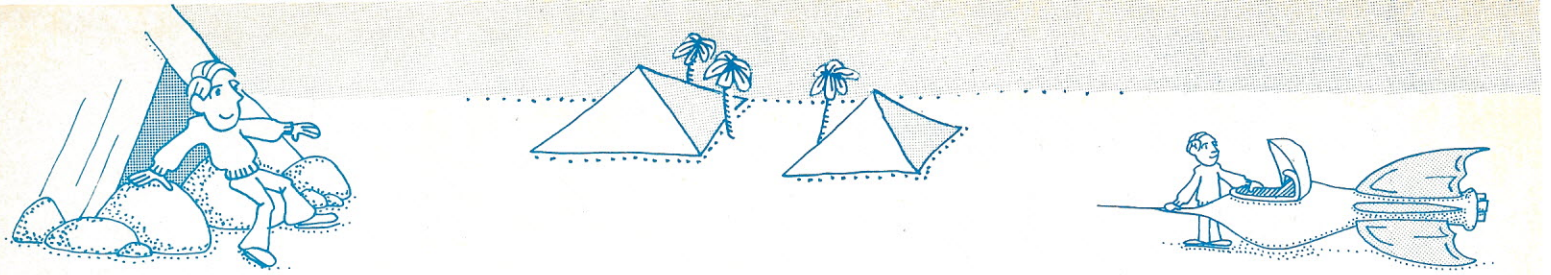
The third aspect of Adventure, Scott Adams himself, is almost as fascinating and varied as one of the games.

Adams first became interested in computers when he went on a grammar school tour to a computer installation. He remembers looking through a large plate glass window at the machines behind it and thinking, "One of these days I'll be on the other side of that window."

The 28-year-old programmer is on the other side of that window now and the transition from one side to the other involved almost as many steps as playing Adventure does for the user.

Adams has been programming since high school (he started in APL computer language) and he eventually wound up in the Computer Science Program of the Florida Institute of Technology, from





which he later earned a BS. Even as a freshman, Scott worked as a programmer for the college on an IBM-1130. As a sophomore he took a machine language course and worked on a Sigma 5 computer while writing an assembler for a Honeywell EDP24.

Other computer-related highlights in Adam's life include working for a software house. During that time he purchased a Sphere (a 6800-based system) for $850. In fact, Scott's purchase was the first order the now-defunct company had. While playing a tank war program on the machine, Adams realized graphics could make the game more interesting; so he designed and built a high resolution graphics board for it, which he then sold to the company. He never realized any profit from the effort, however, since the company went bankrupt. In addition to the graphics board, he wrote an editor, an assembler and real-time driver for the Sphere. Scott also served a stint with the United State Air Force, where he worked as a programmer specializing in Space Object Identification for a computer-driven radar system.

One memory that Adams laughs about today is feeling the Radio Shack TRS-80 had no potential as a consumer product.

"Oh well," he admits, "everybody makes mistakes."

Before long, Scott had a 16K Level I TRS-80 and began experimenting. His experiments eventually led to a Level II machine and his Adventure series. His interest in Adventure started while playing a main frame version he found on a system where he worked.

"I used to come in at six in the morning and stay late in the evening just to play the game," he remarked. "It took me about a week and a half to solve the problems and get a perfect score."

Scott's admiration for the techniques used in the original Adventure bumped around in his head and he decided to write his own version in BASIC.

"I did it in BASIC first for a number of reasons," he explained. "For one thing, I wanted to see how it would run and it was far easier to debug than if I had gone to machine language."

While he developed a viable game in BASIC, Adams later switched to machine language to overcome the slowness of BASIC. Today, all his Adventures are in machine language.

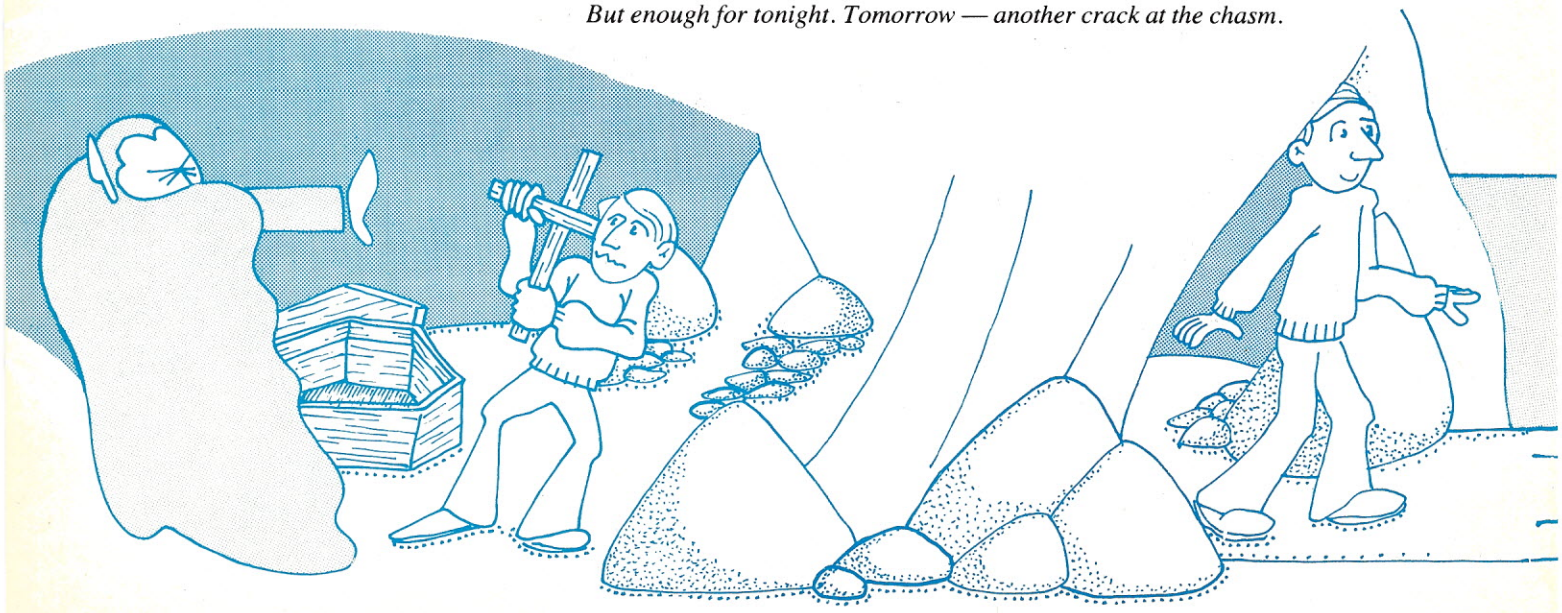
Adams recently opened his own retail outlet, which he calls the "AI Personal Computer Center" in Orlando. And, of course, he continues to create new Adventures to satisfy the addiction of thousands of fans. To date, somewhere between six and seven thousand Adventure games have been sold and that's probably just the beginning if the fan mail he receives is any indication.

If you're tired of video games of bouncing balls or shooting at targets; if you're ready for an intellectual challenge that transports you to new worlds of experience; if you want to see what a skilled programmer can do with a micro, invest in one of Scott Adams' games. An early Adventure (Adventure Land or Pirate's Adventure) is a good place to start because the more Adams creates, the tougher his puzzles get.

While I pondered how to reach the throne room — which I was sure contained the treasures of Croesus — the fog grew thicker and the hours passed. I realized I would not be able to outwit Adams today . . .but maybe tomorrow. I marked my present location on my tattered map and began the long trip to the surface. As I dragged myself off to bed, I thought about other possible Adventures.

Consider scenarios for children studying geography or history in which the permissable paths of solving a particular problem are dictated by the social constraints under which those societies operate. What better way to understand a foreign culture than to live by the rules of that culture? Or how about super-complex scenarios in which the solving of one game leads you through the door of another. That could begin the cycle all over again so several (chained?) programs have to be solved in order to complete a master problem . . .

But enough for tonight. Tomorrow — another crack at the chasm.



Playing Hints

1. Try to visualize each Adventure game in three-dimensional terms; it often makes it easier to make logical moves.
2. Draw maps as you go along.
3. Not all holes are vertical.

Buyer's Guide

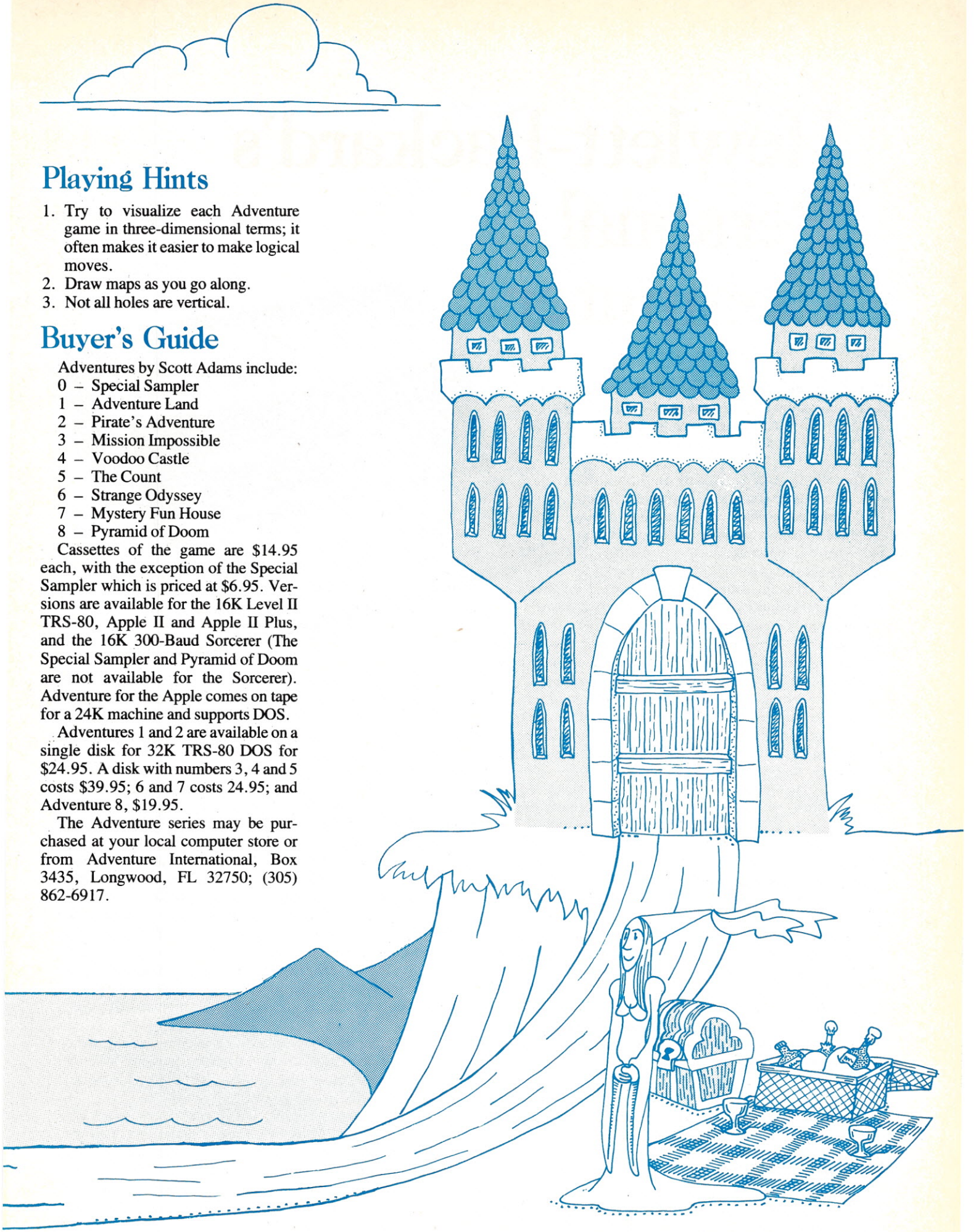
Adventures by Scott Adams include:

0 – Special Sampler
1 – Adventure Land
2 – Pirate's Adventure
3 – Mission Impossible
4 – Voodoo Castle
5 – The Count
6 – Strange Odyssey
7 – Mystery Fun House
8 – Pyramid of Doom

Cassettes of the game are $14.95 each, with the exception of the Special Sampler which is priced at $6.95. Versions are available for the 16K Level II TRS-80, Apple II and Apple II Plus, and the 16K 300-Baud Sorcerer (The Special Sampler and Pyramid of Doom are not available for the Sorcerer). Adventure for the Apple comes on tape for a 24K machine and supports DOS.

Adventures 1 and 2 are available on a single disk for 32K TRS-80 DOS for $24.95. A disk with numbers 3, 4 and 5 costs $39.95; 6 and 7 costs 24.95; and Adventure 8, $19.95.

The Adventure series may be purchased at your local computer store or from Adventure International, Box 3435, Longwood, FL 32750; (305) 862-6917.



Hewlett-Packard's Personal Computer

Hewlett-Packard, well known for its calculators and minicomputers, has entered the field of stand-alone personal computer systems with the introduction of the HP-85. The system is targeted at the professional market.

The HP-85 system features an 8-bit custom processor, typewriter-like keyboard, 5-inch CRT, thermal printer, tape cartridge and graphics capability in an integrated system the size of a portable electric typewriter. The HP-85 is programmed in Hewlett-Packard BASIC. A 20-key numeric pad is provided for data entry or performance of routine arithmetic operations.

Designed for personal use in business and industry by professionals such as engineers, scientists, accountants and investment analysts, the HP-85 also can be used in the home by serious hobbyists and as an instructional computer.

In addition to its computation and graphics capability, the HP-85 is equipped with four input/output ports to hold a range of optional interface modules that will let you expand the system to include plotters, printers, disk drives and other peripherals as they become available.

The system, which comes with 16K of RAM, can be expanded to 32K by plugging an optional memory module into one of the I/O ports on the back of the machine.

The BASIC interpretive language features 12-digit accuracy, string operations, editing, 42 predefined functions, four levels of program security and flexible output formatting. Formatting allows output with headings, columns and spaces.

Another HP-85 capability is built-in, interactive graphics. You can plot data on the display to clarify complex information in pictorial form. For example, technical users can check test results and calculations by doing curve fitting and distribution analysis on the screen; business users can see trends in business operations by looking at a chart or curve instead of long lists of numbers. Further, any graphics display on the CRT can be preserved by printing it with the built-in printer — an operation that can be commanded by pressing one key.

The unit's keyboard is divided into four sets of functions: typewriter keyboard for entering alpha data; numeric pad for entering numbers and doing arithmetic operations; "soft" keys which are assigned a function by you during program development; and display, editing and system control keys which permit you to control the CRT, operating system, tape drive and printer.

In the alphanumeric mode the five-inch black-and-white CRT can display up to 16 lines of data at a time, and each line can contain up to 32 characters. The HP-85 "remembers" up to 64 lines of data, any of which can be viewed by "rolling" the CRT display up or down.

When operating in the graphics mode the display is broken down to a 256 (wide) by 192 (high) dot field providing 49,152 distinct points for high-resolution plotting. Further, the HP-85 stores both the last alphanumeric display and the last graphics display — a feature which allows you to switch from one mode to the other without losing data from either.

The bidirectional thermal printer, which operates in both alphanumeric and graphics modes, prints two 32 character lines per second. In the alphanumeric mode it can print the full 128 ASCII character set, which consists of upper and lower-case letters, numerals and special symbols. Additionally, the full character set can be underlined. Company representatives said the unit was not designed as a word processing system as the HP-85 has limited text editing features.

In the graphics mode the printer can reproduce any plot on the CRT under program control or by pressing a button. When plotting, the printer "rotates" the display 90 degrees, giving it capability to print endless strip charts.

The HP-85 tape drive uses HP data cartridges, which have a user capacity of 217K bytes, and operates at a read/write speed of 10 inches per second and a search speed of 60 inches per second. The HP-85 automatically sets up a tape directory at the beginning of each tape. Using this "table of contents," the system can automatically find exact tape locations of recorded programs and data.

Nine application software packages are immediately available on prerecorded cartridges for the machine, and packages combining a number of other commonly used programs are under development. Other programs will be available in written form from a users' library, and BASIC programs developed for HP's desktop computer systems can be adapted for use on the HP-85.

HP-85 application software available on prerecorded cartridges include BASIC training, general statistics, mathematics, electrical engineering, finance, linear programming and regression analysis. The BASIC training pack consists of a 19-lesson, self-instruction course in which the system initially controls the whole process but slowly gives up that control as you become familiar with operating the unit.

The HP-85 is 16 inches wide, 18 inches long, 6 inches high, and weighs under 20 pounds. A 350-page owner's manual describing operation and programming comes with the machine. Also included is a standard application software package which contains 15 HP-85 programs.

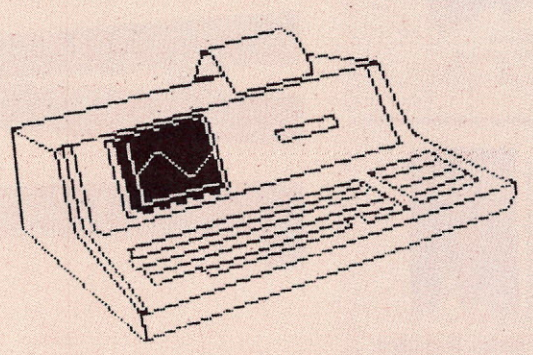
The HP-85, under development for three years and in production for over three months, will be distributed by Hewlett-Packard dealers, office equipment suppliers and computer stores. The system comes with a 90-day warranty and can be serviced at HP centers worldwide. Anticipated delivery time on the unit is 8 to 12 weeks after sales of the initial production runs.

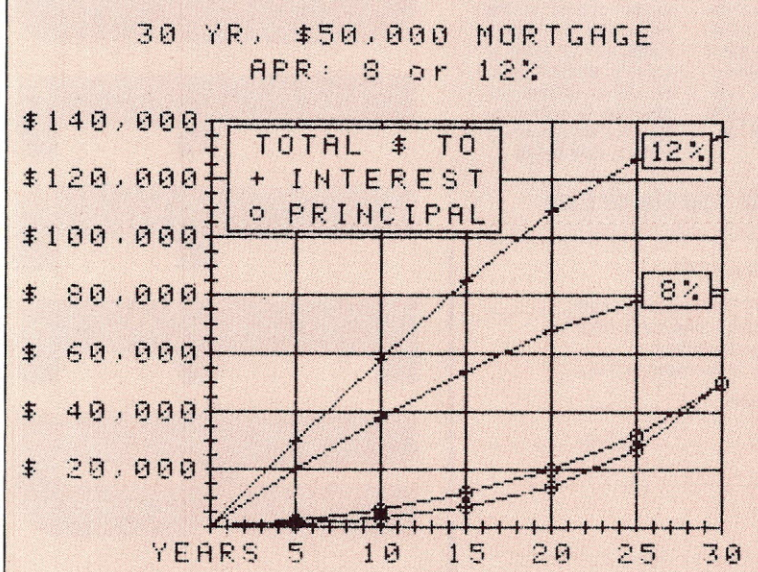
The system will retail for $3250 with application cartridge pacs selling for $95 each. Tape cartridges sell for $18 each (blank) and the 16K memory module will be priced at $395. The owner's manual is $25 with a pocket guide going for $5.

For more information contact Inquiries Manager, Hewlett-Packard Co., 1507 Page Mill Rd., Palo Alto, CA 94304. □

Sample Run

The HP-85's printer capabilities, which range from graphics to alphanumeric reproduction, are shown here at 100% of their original size. Graphics have been rotated 90 degrees.





HP-85 CHARACTER SET

EACH OF THE SYMBOLS SHOWN BELOW MAY ALSO BE PRINTED OR DISPLAYED WITH UNDERLINING

ENGLISH LETTERS

ABCDEFGHIJKLM
NOPQRSTUVWXYZ
abcdefghijklm
nopqrstuvwxyz

GREEK LETTERS

αβΓΔδθλμπΣστΦΩ

OTHER LETTERS

AäÄäÖöÜÜÆæ

NUMBERS

0123456789

MATHEMATICAL OPERATORS AND SYMBOLS

+-*/\^.<>#=()

PUNCTUATION

!?.:;,"'()[]

OTHER CHARACTERS SHOWN ON KEY CAPS

@#$%&_|

OTHER CHARACTERS NOT ON KEY CAPS SHOWN

◀¿x̄N̄n̄↑²£▒`→⊢

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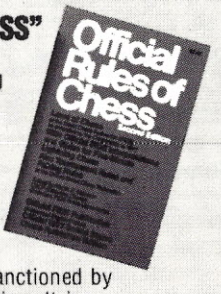

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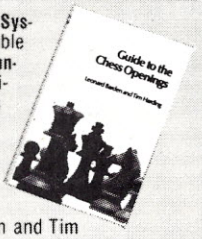

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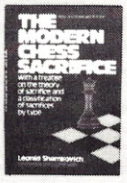

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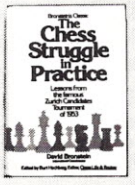

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SPECIAL OFFER

HARRY SHERSHOW – Dept. Editor
MORRIS MILLER – Chess Annotater

Micro-Chess at London Bridge

While the "big machines" (and some smaller ones) were competing against each other in Detroit for the 10th ACM Computer Chess Championships (won by CHESS 4.9 for its 8th title in the last ten tournaments), over in London nine micros were staging their own spectacle in the 2nd Annual **Personal Computer World's** Chess Tournament. Winner of that tournament was the very new Chafitz-Sargon III unit and winner of the money prize (awarded to non-commercial programs) was VEGA. The final standings of this tournament were:

1.	CHAFITZ-SARGON III	5 pts.
2.	VEGA	3-1/2 pts.
3.	TINY CHESS	3 pts.
	MYCHESS	3 pts.
	MIKE II	3 pts.
6.	VOICE CHALLENGER	2-1/2 pts.
7.	DELTA	2 pts.
	MAX	2 pts.
9.	WIZARD	1 pt.

John Urwin was at the tournament with his MYCHESS entry running on the Cromemco and filed this report:

"Star of the tournament was SARGON III by a strong margin as it won all of its five rounds. Time control was set at 30 moves in 60 minutes and the prize of $3000 went, by agreement, to the highest scoring non-commercial program, VEGA. Following is a description of all the participants:

"MIKE II was programmed on a Z-80 based home brew system by Mike Johnson of 26 Carlton Court, Auckland Road, London SE19 2RS England. MIKE had won the first PCW tournament last year. For this event, Mike says that he threw together a new chess program in FORTRAN in just a few weeks. He indicated that he had been working on another program but had been unable to finish it in time for this contest. Mike feels that the program he is working on is going to stir up a lot of interest when it is finished. He is writing it in FORTRAN, also, he says, so that it can run on much larger systems.

"The brand-new CHAFITZ-SARGON III entry was authored, as everyone should know by this time, by Dan and Kathe Spracklen of California. It is housed in a dedicated 6502-based chess module and is commercially produced by Chafitz, Inc., 1055 First Street, Rockville, MD. Dan Neumayer of the Chafitz Company, who was at the tournament, explained that SARGON III is only a developmental program right now and is not yet ready for market. Expectations are that it will be available by late 1980. However, it is my belief that anyone who is putting off buying **any** commercial unit now because he is waiting for stronger units to become available later, is missing the fun. Get one of these units now and by the time you have it mastered it will be time to trade it in, like a new car! People who wait for new cars to improve to their liking will never get to ride around in an automobile. According to Dan Neumayer, SARGON III, when it finally shows up on the shelves, will have a USCF rating of around 1800! (That's better than the great majority of chess players in the United States.) The SARGON 2.5 model, which should be currently available, is estimated by Chafitz to be capable of playing around 1600.

"MYCHESS was written by Dave Kittinger of 2431 Lyvona Lane, Anchorage, AK, 99502. It has been programmed to run on a Cromemco (Z-80 based) system. Dave, an electrician in Alaska, is a USCF member with a rating around 1900. MYCHESS, which had been seeded in 12th and last place at the recent ACM tournament in Detroit, surprised everyone by finishing in 6th place. The playing strength of this program is estimated to be about 1600. According to Dave, some slight changes planned in the immediate future, should boost up the playing strength of MYCHESS. Right now, Dave is in the process of converting the program to play on the TRS-80 and on the APPLE II.

"VOICE CHALLENGER is a Z-80 based stand-alone device by Fidelity Electronics, 8800 Northwest 36th St., Miami, FL 33178. VOICE CHALLENGER is the strongest in the series of chess models from Fidelity and

should not be confused with the playing strength of CC-7 or CC-10. At this writing, Fidelity was reportedly getting ready to reveal a new, stronger-playing device, in time for January's Consumer Electronic Trade Show. That is the place where all companies show off their newest devices in the electronic field. VOICE CHALLENGER is capable of playing a better game than it did in London and its 6th place finish came as a surprise. (It lost a flukey game to TINY CHESS - otherwise it would have been in second place.) Evidently, computers, like humans, have emotional problems and can experience 'off days.'

"VEGA was developed on a North Star Horizon by David Broughton from England. The program uses a very primitive evaluator and will perform a five-ply search in two minutes. Dave indicates that VEGA looks at about 500 nodes per second and during end-game play, a 9 ply search is not uncommon.

"MAX was written by Guy Burkill of 27A Devonshire Close; London, W1N 1LG England. It runs on an APPLE II. MAX managed to eke out only one game at the tournament and that was against WIZARD which won no games at all.

"DELTA is the work of Dave Wilson, 1 Alexandra Court, Alexandra Park Road, London N22 48Q, England. It operates through a TMS9900 +64 bit Chess Hardware which probably made it the strongest unit at the tournament. However, DELTA managed to win only one game and that was against luckless WIZARD. Dave says that the program was only recently whipped together and he has had no time to test it out and tighten it.

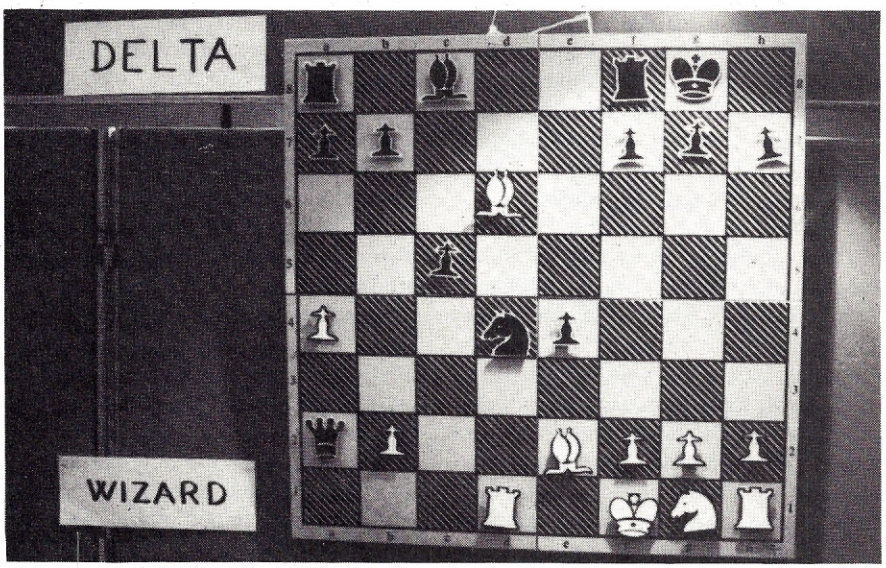
"TINY CHESS was a 'foreign import.' It came from Belgium and is the work of Jan Kuipers of Rue St. Lambert 5, 5900 JODOIGNE. Jan describes his program: 'TINY CHESS runs on an Intel 8086 based system. It takes up 3K of ROM and uses 1K of RAM. It is packaged on a single 3" x 3" printed circuit board which will interface to any video terminal through an RS232. The program has no book opening and can start a game with some such unusual play like Na3.' This random move actually worked well against VOICE CHALLENGER which did not have a book response to that unorthodox opening and eventually lost on time, thus contributing to CHALLENGER'S poor showing.

"WIZARD was programmed by Jeffrey Cooper of Glen View, Burnley Road, Causeway Head, Halifax, West Yorkshire, England. It runs on a home brew 8080A system. WIZARD lost every game and was no challenge to anyone. I am sure Jeff will be making some improvements to the program unless he has become too disheartened by his losses and decides to give it up altogether.

"After reviewing all the games and estimating the playing strength of the programs at **this tournament** I would list the participants in the following order:

1. SARGON III
2. MYCHESS
3. VEGA
4. VOICE CHALLENGER
5. MIKE II
6. DELTA
7. MAX
8. TINY CHESS
9. WIZARD

"Some tournament blips . . . CHAFITZ-SARGON III attracted most attention and most comments. SARGON displayed a strong desire to win pawns in most of its games . . . Tireless David Levy, just back from directing the ACM Chess Tournament in Detroit, spent so much time here that he missed a dinner date with his wife and had to settle for a lonesome sandwich at the local pub . . . . Dave Wilson of DELTA was ecstatic because his "green" program had taken one game (its only victory) over winless WIZARD . . . Jeff Cooper, of WIZARD had a glum expression all day as he watched his home-brew 8080A system lose all its games . . . VOICE CHALLENGER won a nice 43-move game against MIKE II (1978 -ACM-participant.) . . . Most unusual device shown was Belgian Jan Kuipers' TINY CHESS single board module which hooked up to a video terminal via an RS232 interface. Jan could not believe that his TINY CHESS had been beaten by MYCHESS in only 17 moves; so, challenged MYCHESS to a second (non-official) game. This time he lost in 14 moves . . . Kevin Byrne from COMART (Cromemco dealer in London) spent a solid half-hour assuring Dave Kittinger that the system had not crashed. MYCHESS was taking 45 minutes to make move 61 in its game against VEGA. MYCHESS then went on to lose this game on time elapse and consequently gave up a certain second-place finish . . . VEGA included in its display evaluations of current positions in the upper left of screen. A nice aid for the spectators . . . At one point in its game against MYCHESS, VEGA displayed a value of -124 (which is 12



Game board at the London Tournament shows WIZARD "doing what comes naturally" — losing. WIZARD failed to win any of its four games. In this terminal position against DELTA its demise is imminent as WIZARD has already given up its queen.

points greater than a checkmate!) Although Dave Broughton worried a good deal about this, VEGA finally got the game as a gift as MYCHESS ran into time trouble.

"In conclusion I have to say that this London tournament was a wonderful demonstration for the hobbyist. It proves that anyone with a microcomputer and with determination plus some 'know-how' can write his own microcomputer chess program. Five programs proved that observation: VEGA, MAX, DELTA, WIZARD and TINY CHESS — all written by 'amateurs' in their own basement workshops. I think the performances and achievements of these five should encourage the development of more computer programs from U.S. hobbyists. Any one who can write an original chess program should have no trouble writing any other type of computer program.

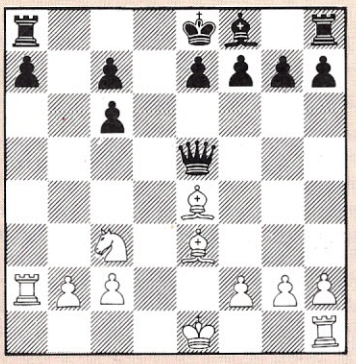
"Games of that tournament not shown in this issue will be upcoming in future issues."

Another London Blitz

BY MORRIS MILLER

Odds giving has always been the hallmark of the chess master. But it is a field into which chess-playing programs have not ventured — at least up to now. However, if they can play speed chess and solve problems, why not play at odds? Here is a game from London, where Sargon III against Voice Challenger gives odds of the queen and the game is played at blitz speed (60 moves in five minutes).

White: Sargon III (Queen off)	Black: Voice Challenger
1. N-QB3 (a)	N-KB3
2. P-K4	P-Q4 (b)
3. PxP	NxP
4. NxN	QxN
5. N-K2	B-B4
6. P-Q3	Q-B3
7. N-Q4	Q-Q4
8. N-K2	B-K3
9. N-B3	Q-QR4
10. B-K3	BxP (c)
11. RxB	Q-K4
12. P-Q4	Q-K3
13. B-Q3	N-B3?
14. P-Q5	Q-K4
15. PxN	PxP
16. B-K4	R-Q1 (d)
17. BxPch	R-Q2
18. BxRch	KxB
19. RxP	P-K3
20. 0-0	B-B4?



Position After White's 16th Move

21. R-R5	K-Q3?
22. RxB	Q-B3 (e)
23. N-K4ch	K-Q2
24. R-Qlch	K-B1
25. NxQ	PxN
26. R-QR5	K-N2
27. R-Q7	R-KB1
28. R-R7ch	K-N1
29. R(Q7)xQBP	R-Q1
30. R(B7)-N7ch	K-B1
31. R-B7ch	K-N1
32. R(R7)-N7ch	K-R1
33. R-R7ch	K-N1 (f)
34. R-Q7	RxR
35. RxR	P-R4
36. RxP	P-B4
37. R-K7 (g)	K-B1
38. RxP	K-N2
39. R-KR6	P-R5
40. RxP	K-B3
41. R-Q4	K-B2
42. P-R4	P-B5
43. BxPch	K-B3
44. P-QN4	K-N4
45. P-R5	K-B3
46. P-R6	K-N4
47. P-R7	K-B3
48. P-R8=Q	K-N4
49. Q-B6	K-R5
50. Q-QR6 mate	

(a) In odds giving it is best to steer the opening out of the books, which Sargon does at the start if not later.

(b) Being ahead, black naturally tries to open up the game and promote exchanges. If now 3-P-K5, P-Q5.

(c) The only way to account for this move is that Voice Challenger assumed the knight, being pinned, could not capture, and if the rook captured the queen could take, the knight being pinned. This sort of error in thinking is exactly what a human player would make.

(d) The text move makes matters worse. Either R-QN1 or P-K3 or P-B3 was forced. However, black would have been better off if instead of 15-. . .PxP it played 15-. . .P-Q N3. Now Sargon is almost even in material and ahead in position.

(e) If 22-. . .QxR; 23-N-K4ch; the queen actually is lost on the open board

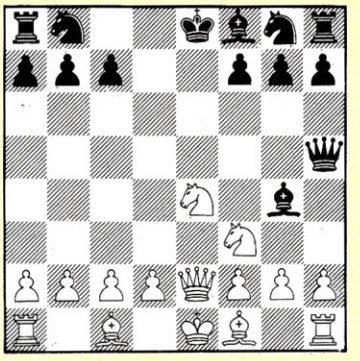
(f) If the reader wonders why the game continues, it is because in blitz chess a player may have a won game but if five minutes is exceeded before 60 moves are made, that player loses.

(g) Now the quickest is 37-B-N6, followed by K-B1, K-K2, K-Q3, K-B4, K-B5, K-B6 and R-B8 mate.

Sargon had an easy job, but with some improvement Voice Challenger should prove a far more formidable opponent.

The shortest game at the London Tournament was Mike against Wizard. It never really got beyond the opening moves:

MIKE II White	WIZARD Black
1. P-K4	P-K4
2. N-KB3	P-Q4 (a)
3. PxP	P-K5
4. Q-K2	QxP
5. N-B3	Q-KR4
6. NxP	B-KN5? Diagram



7. N-B6 (double check) K-Q1
8. Q-K8 mate

(a) The Center Counter Gambit is a difficult game for black to play. The best advice is stay away from it. Being behind a move, the second player cannot hope to come out ahead this way.
Of course, Wizard on its sixth move overlooks the double check, leading to the amusing and typical mate. — M.M.

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The Welsh Tournament Continued . . .

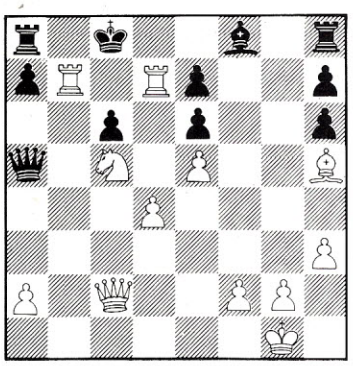
(Last month's issue described the first three games of a 10-game evaluation "tournament" held between Chess Challenger 7 and David E. Welsh of Los Angeles. David is a consulting mechanical engineer and a 1900-rated chess player. His purpose in analyzing CC-7 was to find out how machines played in general, their weaknesses, their strengths, their promise, and how they might be improved. Here are the rest of the games from the tournament. Previously, David had "met" the Challenger three times and had won all three games. Comments on the games are by David Welsh.)

GAME 4 - LEVEL 3

CC's worst effort of the match is not without a certain grim humor, of the the "crime and punishment" variety.

BLACK: CC 7 Queen's Gambit 1 d4 d5 2 c4 c6 3 Nf3 dxc4 4 e3 Be6?? It's well known that Black can't hold the Pawn; CC makes an atrocious move in trying to do just that.

5 Nc3 Nf6 6 Ng5 Qd6? 7 e4 Ng4?
8 h3 Nh6 9 Be2 Nd7? 10 e5 Qb4
11 Nxe6 fxe6 12 Bxh6 gxh6 13 Bh5+ Kd8 14 0-0 Qxb2? 15 Na4 Qb5
16 Rb1 Qa5? It's surprising that CC would give up the Pawn here, and bad of course to let the Rook in on the 7th rank.
17 Rxb7 c3? 18 Nc5 c2? 19 Rxd7+ Kc8 20 Qxc2 Kb8?? 21 Rb1+ Kc8 22 Rlb 7 . . .



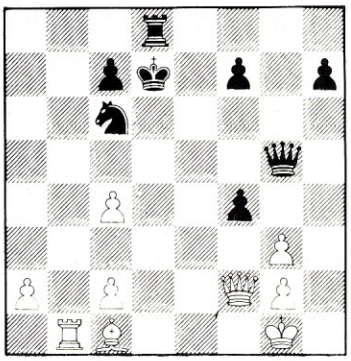
Individual comments on CC's many bad moves are unnecessary; this Diagram says it all.

22 . . . a6 23 Qb3 Qe1+ 24 Kh2 Qa5
25 Rbc7+ Qxc7 26 Rxc7+ Kxc7
27 Qb7+
1 - 0

GAME 5 - LEVEL 7

In this game I essayed the King's Gambit, which didn't intimidate CC at all, and soon regretted my choice as it got the upper hand; then CC obligingly spoiled its position and gave me the initiative, leading to some interesting tactics; when it became clear that CC had to lose its Pawn, it blundered and soon lost its Queen as well.

BLACK: CC 7 King's Gambit
1 e4 e5 2 f4! 2 exf4 3 Nf3 Nc6
Though not in the opening manuals, this is by no means a mistake.
4 Bc4 . . . On 4 d4 Black continues
4 . . . Nf6! and now 5 e5 Nh5 6 d5!? is risky; 6 . . .Nxe5!? 7 Nxe5 Qh4+ 8 Ke2 Bc5 9 Qe1 Ng6+ 10 Kd1 0-0!
11 Nf3 Qh5 impressed me as very strong for Black.
4 . . . Nf6! Usually a good move in this opening.
5 Nc3(?) . . . Analyzing the position afterward, I concluded that White ought to play 5 Qe2 with a sort of Lopez Gambit position.
5 . . . Bb4 6 d3 d5! As always, this equalizes.
7 exd5 Bxc3+ 8 bxc3 Nxd5 9 Ba3? . . . Correct was 9 Bxd5 Qxd5 10 Bxf4 =.
9 . . . Be6! I'd been expecting CC to take the Pawn, after which its position might have become critical.
10 Bxd5 . . . Unfortunately forced.
10 . . . Qxd5 11 0-0 . . .
11 . . . b5? Just as it became clear that CC had the advantage, it spoiled its position with this ill-timed advance. If CC had to push a Pawn, . . . g5 was appropriate.
12 Qd2 g5 13 Rfe1 O-O-O 14 Qf2! a5? Thanks to two impulsive Pawn moves, White now has the advantage.
15 Re4 Rhe8 16 c4 bxc4 17 Rxc4 . . . Here a human opponent would have been regretting Black's 11th and 14th moves, but that's a capability CC doesn't have.
17 . . .g4. Play now becomes highly tactical.
18 Rc5 Qd6?! 19 Rxa 5 Nb4 20 Ne5 Bd5 21 Nc4 Qf6 22 Rb1 Nc6 23 Ra8+ Kd7 24 Rxd8+ Rxd8 25 Bb2 Qg5 26 Bc1 . . . Not 26 Rf1? f3! The tactical complications have led to the gain of a Pawn.
26 . . . Bxc4 27 dxc4 g3 28 hxg3 . . .



(The critical moment. After 28 . . . Qxg3 29 Bxf4 Qxf2+ 30 Kxf2, White has considerable advantage in the ending, but hardly a forced win.)
28 . . . fxg3?? 29 Qxf7+ Qe7 30 Qf5+ Qe6 Other moves lose to 31 Bg5.
31 Qxh 7+ Ne7 32 Bg5 Qd6? Creating a dangerous lineup.
33 Qh3+ Ke8 34 Qh5+ Kd7?? This is an example of CC's limited look-ahead capability; it saw its move, my reply, its next move, but not my second move — when the Queen would actually be captured.
35 Rd1 Rc8? Loses more material.
The remaining moves were:
36 Qg4+ Kc6 37 Rxd6+ cxd6 38 Bxe7 Rc7 39 Qe6 Rd7 40 c5 Rb7 41 Qxd6+ Kb5 42 a4+ Ka5 43 Bd8+ Kxa4 44 Qa6+ Kb4 45 Qxb7+ Kxc5 46 Be7+ Kd4 47 Bd6 Kc3 48 Qb3+ Kd2 49 Bf4+
1 - 0

GAME 6 - LEVEL 7

In this game I began recording time used by CC — the first number in the parentheses is the number of minutes for the move just made; the second is the cumulative total. The game offers some insights into CC's strategic goals and misunderstanding.

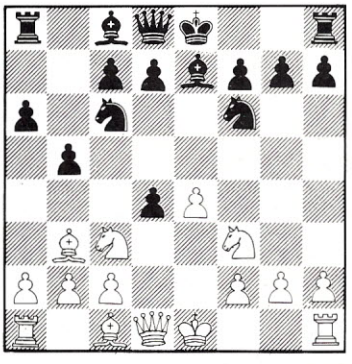
WHITE: CC7 Queen's Pawn Opening

1 d4(0/0) Nf6 2 Nf3 (1/1) g6 3 Nc3 (1/2) d5 4 Qd3 (2/4) Bg7 5 e4 (3/7) c6 6 Bf4(4/11) O-O 7 Be2(4/15) . . .
This seems to be CC's concept of an ideal opening position, both center Pawns advanced, all its minor pieces developed, and ready to castle.
7 . . . Na6! 8 a3(7/22) Nc7 9 O-O(5/27) Nh5! Well, maybe that Bishop wasn't

ideally posted after all.
10 Bxc7(5/32) . . . At this point I believe CC thought it was winning a Pawn.
10 . . . Qxc7 11 Qe3(5/37) . . . CC notices that 11 exd5 is answered by Nf4.
11 . . . Nf6 Mission accomplished; this creates a new threat.
12 Rad1?(5/42) . . . Which CC overlooks, as it can't see 4 moves ahead.
12 . . . Nxe4 13 Nxe4(3/45) dxe4 14 Ng5(3/48) CC now sees that 14 Qxe4 is answered by . . .Bf5 winning the c-Pawn.
Perhaps it was hoping for 14 . . . f5??
14 . . . Bh6! 15 F4?(4/52) . . . It was better to exchange by 15 Ne6.
15 . . . Bxg5! This is much better than securing the Pawn plus by 15 . . . exf3, for now the White g-Pawn will be weak, and the still-immune e-Pawn cramps White considerably.
16 fxg5(2/54) Qd6 17 Qxe4?!(3/57) . . . Better was 17 Bc4 followed by an attempt to win the e-Pawn.
17 . . . Bf5 18 Qe5(3/60) Bxc2 19 Rd2(2/62) Bb3 20 Rf3?!(8/70) . . . This is a strange move, but from CC's point of view logical — it greatly increases the Rook's mobility. Unfortunately for programmers, mobility is not always useful.
Humans would prefer 20 Bf3, with the goal of an eventual d5.
20 . . . Bd5 21 Qxd6(1/71) exd6 22 Re3 (1/72) . . . CC suddenly started to play very rapidly here — did it think it was in time trouble?
22 . . . Rfe8 23 Rdd3??(1/73) . . . A terrible blunder which loses the Exchange and the game.
23 . . . Bc4 24 b4?(2/75) . . . When CC is unable to find a good plan, it seems to be programmed to advance a Pawn. This just makes matters worse.
24 . . . Bxd3 25 Rxe8+(1/76) Rxe8 26 Bxd3(0.5/76.5) Re3 . . . Black now has an easy win. CC took from a few seconds to one minute for each of the remaining moves, which were:
27 Bc4 d5 28 Bf1 Rxa3 29 b5 Ra4 30 bxc6 bxc6 31 Be2 Rxd4 32 h3 a5 33 g3 a4 34 h4 a3 35 h5 a2 36 Kf2 a 1(Q) 37 h6 Rd2 38 g4 Qb2 39 Kg2 Rxe2+ 40 Kg3 Qc3+
0 - 1
CC used a total of 85 minutes.

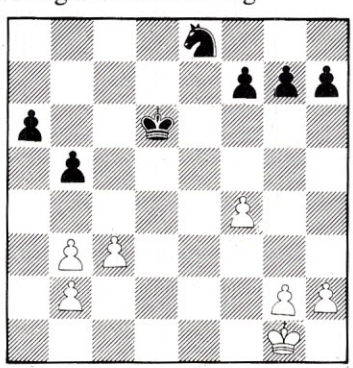
GAME 7 — LEVEL 7
CC repeats the opening error of game 4, though the sequel is not as bad. In an inferior but far from hopeless position, CC gave a horrible exhibition of positional ineptitude to reach a lost position in another 6 moves. CC immediately found itself on the defensive; White's initiative grew with each move; and finally a helpless CC was mercifully mated.
BLACK: CC 7 Queen's Gambit 1 d4 d5 (0/0) 2 c4 c6(0/0) 3 Nf3 dxc4 (2/2) 4 e3 Be6??(2/4) The same atrocity it committed in game 4.
5Nc3 Nd7(2/6) 6Ng5 b5(2/8) 7 Nxe6 fxe6(2/10) 8 a4 Rb8?(4/14) Again CC overlooks the obvious, due to its three-ply search depth — seeing only 8 . . . Rb8 9 axb5 cxb5, and then counting heads.
9 axb5 cxb5(2/16) 10 Rxa7 Ngf6(2/18) 11 Ra6 Rb6(2/20) 12 Rxb6 Qxb6(2/22) 13 Be2 . . .
White will simply complete his development, then try to exploit Black's positional weaknesses. A human in CC's position would play . . . e5 as soon as possible, followed by . . . e6 with an inferior position, but one offering defensive resources. Instead we see an instructive example of CC's limitations.
13 . . . h5?(2/24) 14 O-O Qa6(2/26) 15 Bf3 b4?(1.5/27.5) Here we see CC at its worst, executing a program rather than playing Chess. Its 13th move gained Rook mobility; the sequel to this one indicates CC attaches value to Pawns reaching the sixth rank.
16 Ne2 h4?(1.5/29) 17 h3 b3?(2/31) 18 Nc3 g5?(2/33) In just 6 moves CC has turned a defensible position into a mess that nobody could hold.
Obviously CC doesn't understand weak squares. White now expands from a rather restricted position to control of the whole board in a striking manner — the finale is all fortissimo.
19 e4 Nh7(2/35) 20 e5! Bg7?(3/38) 21 Ne4 Bh6(4/42) 22 Bh5+ Kd8(1/43) 23 Bg4 Qb6?(2/45) A tactical error.
24 Nc5! Nhf8(2.5/47.5) 25 Be3 Qc6(3/50.5) There's danger in the Queen staying on that diagonal, e.g., . . .
Nb8? 26 d5 exd5 27 Ne6+. 26 Bf3 Qb6(3/53.5) CC thinks there's no danger now that the bishop has left the h3-c8 diagonal. Really?
27 Qd2 Nh7(1.5/55) 28 Ra 1 Nb8(5/60) Now that it's far too late, CC senses danger and starts analyzing farther ahead.
29 d5! Kc8(2.5/62.5) Other moves lose even more quickly, e.g. . . . exd5 30 Qxd5+ Kc8 31 Bg4+.
30 Nxe6 Qb5(2.5/65) 31 Ra7 Nbd7(4/69) Mate was threatened, the only alternative being to give up the Queen.
32 d6 . . . The mating net tightens. Also mating quickly was 32 Rc7+.
32 . . . Nxe5(3/72) CC misses mate in 2, butthere was no way out; e.g., 32 . . . Nb6 33 dxe7; or 32 . . . Qb8 33 Qa5. 33 Rc7+
1-0.

GAME 8 - LEVEL 7
CC fall into a famous opening trap, and after a rapid reduction of material, it demonstrates total endgame ineptitude.
WHITE: CC 7 Ruy Lopez 1 e4(0/0) e5 2Nf3(0/0) Nc6 3Bb5(0/0) a6 4Ba4(0/0) Nf6 5 Nc3(3.5/3.5)Here CC was at the end of its opening "book". This is not White's best continuation, for reasons which will become apparent.
5 . . . b5! This variation is quite easy for Black to equalize.
6 Bb3(2.5/5.5) Be77 d4?!(3.5/9). . . A dubious move, but CC doesn't realize the danger and is now happy with its opening position.



7 . . . exd4 A well-known position, which many a novice has had reason to remember.
8 Nxd4?(2/11) . . . The "Noah's Ark" trap claims another victim; I knew CC would fall into it, because it can't analyze far enough ahead to see the result. Here White must play 8 Nd5 after which Black can hold on to the Pawn for some time — it's best for White to avoid the whole variation.
8 . . . Nxd4 9 Qxd4(2/13) . . . If you

haven't seen this before, it still may not seem that White is in any danger here.
9 . . . c5 10 Qd2?(3/16) . . . CC ought to play 10 Qd3 and at least get two Pawns for the Bishop.
10 . . . c4 11 O-O(2.5/18.5) cxb3 12 e5!?(2.5/21) Here CC reacts like a human, with a desperate attempt to stir up complications.
12 . . . Ng4 13 Qd5(5/26) Rb8 14 axb3(4/30) d6! Now it's clear that White has nothing.
15 Bf4(5/35) Bb7 16 Qd4(6/41) dxe5 17 Bxe5(5/46) Qxd4 18 Bxd4(3.5/49.5) O-O 19 f3(1.5/51) Nf6 20 Rae1(2.5/53.5) Obviously, the wrong Rook.
20 . . . Rfe8 21 Rf2(3.5/57) Bd8 22 Rxe8+(2/59) Nxe8 23 Be5(1.5/60.5) Bc7 24 Re2(1.5/62) . . . CC can't think up any good traps here, so it exchanges all the pieces, which was quite agreeable.
24 . . . Bxe5 25 Rxe5(1/63) Kf8 26 Nd5(1/64) Bxd5 27 Rxd5(1/65) Ke7 28 c3(1/66) Nc7 29 Re5+(1/67) Kd6 30 f4(1/68) Re8 31 Rxe8(1/69) Nxe8 At this point I said to myself, just to make things a little more interesting, let's leave the Knight sit on e8 and play this as a King and Pawn ending.

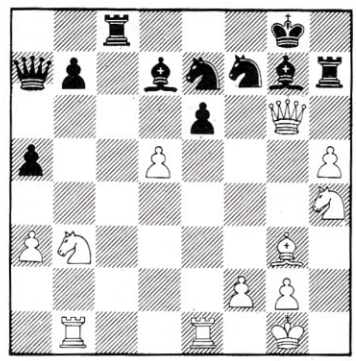


32 c4??(.25/69.25) . . . At this point CC began to play each move in a few seconds, and demonstrates that it has absolutely no capability for playing endgame.
32 . . . Kc5 33 f5? bxc4 34 bxc4 Kxc4 35 g4?Kb3 36 Kf2 Kxb2 37 h4 . . . It no longer makes sense to criticize CC's aimless moves, since nothing would make any difference.
37 . . . a5 38 Kf3 a4 39 h5 a3 40 f6 g6 41 hxg6 hxg6 42 g5 a2 43 Ke3 a1(Q) 44 Kf3 Qe1 45 Kg4 Qe3 46 Kh4 Kc2 47 Kg4 Kd2 48 Kh4 Ke2 39 Kg4 Kf2 0-1

Level 5 - Postal Chess

At this point the match was interrupted to try out CC's Level 5, at which the response time is stated as 24 hours average. Curious to see how deeply CC could analyze with virtually unlimited time, I presented it with this position:

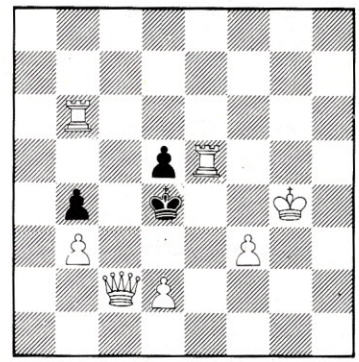
(Welsh-Dunning, US Open 1968)



White to move and win.

After more than 77 hours (!!), CC found the solution:
1 dxe6!! Nxg6 2 exf7+ Kxf7 3 hxg6+ Kg8 4 gxh7+ Kxh 7, at which point CC could count heads and decide that this was a gain of material. It was easy to determine that CC couldn't possibly have seen the further continuation 5 Re7 Bg4 6 Be5 Rg8 7 Nd4 Qc5 8 Rlxb7 Qc1+ 9 Kh2 Kh6 10 Bxg7+ (captures faster than the better move 10 Nhf5+ as played in the game).
In an open position such as this diagram, each move-pair generates about 2000 possible legal positions, and to search ten moves deep would involve something like 1×10^{33} possible positions after the 10th move. This is a task beyond the capacity of any conceivable computer.
Fortunately for programmers, a technique known as the alpha-beta search algorithm can search a "tree" of N possibilities by evaluating only $2\sqrt{N}$ cases, which for the 10-move "tree" would be about 6.3×10^{16} positions, still far beyond the capacity of present large-computer programs.
To measure CC's search rate, I tested it on a simple mate in two (see diagram):
CC found the solution (1 Qdl) in 45 seconds. Hand tabulation showed a total of 1,395 legal positions after White's second move. If CC looked at them all, its search rate would be about 30 positions per second.

(V.C. Baja, Chess Life and Review, 10/76)

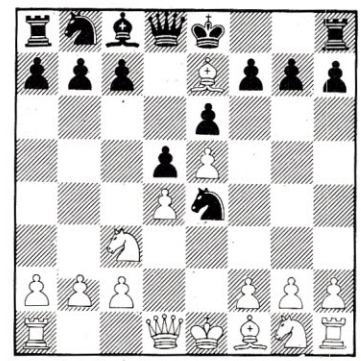


At that rate, it would take CC 34 million years to search the 10 move "tree"! Using the alpha-beta algorithm, to search the four move "tree" of 1.6×10^{13} possibilities requires 8,000,000 evaluations, which at 30 per second would take 74 hours. We may conclude that CC's practical look-ahead limit is 4 moves at level 5.
Similar calculations reveal that in an open position it would take CC 7 2.22 minutes to do a two-move (four-ply) search, 7.44 minutes to add its opponent's reply and do a 2 1/2 move (five-ply) search, and 49 minutes to do a 3 move (six-ply) search.

Game 9 - Level 6

CC falls into the same trap as in Game 8, less because it enjoyed the experience, than for reasons of limited horizon.

WHITE: CC 7 Ruy Lopez
1 e4(0/0) e5 2 Nf3(0/0) Nc6 3 Bb5(0/0) a6 4 Ba4(0/0) Nf6 5 Nc3(10/10) . . .Even with increased look-ahead time, CC selects the same variation.
5 . . .b5 6 Bb3(5/15) Be7 7 d4?!(6/21) exd4



8 Nxd4?(9/30) . . . .Though spending as much time on its moves as a top

Grandmaster in a World Championship match, CC falls for it again and apparently would do so 100 times out of 100. Why?

In the opening position, a move-pair generates about 1420 legal positions, and permutating this leads to a four-move "tree" size of 4.07×10^{12}. Searching this by the alpha-beta algorithm requires evaluating 4,032,000 positions, which at 30 per second would take CC 37 hours. And that's how far it would have to calculate to see the trap.

During the 9 minutes CC spent on this move, it could only do a five-ply search — which means that it saw 8 Nxd4 Nxd4 9 Qxd4 c5 10 Qd2 (for example), at which point it counted heads, and since White hasn't lost any material at this point it thought that the variation was OK.

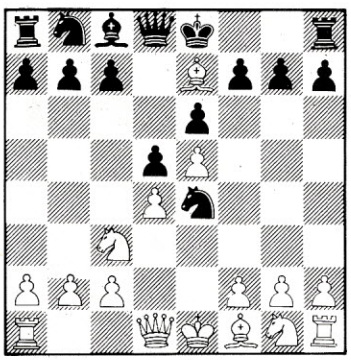
It is clear that CC will almost always fall into traps where the actual capture of material or mate occurs 3 moves ahead, since a six-ply search would take anywhere from 30 minutes to an hour depending on the complexity of the position.

Here the Match Director informed CC of its egregious blunder, and suggested that it resign. At first it didn't understand, but after the Reset button was pressed, CC complied.

Game 10 — Level 6

CC's limited horizon leads it into one faulty move after another, soon achieving a lost position. Eventually it lost a piece. To add interest to a routine ending, I underpromoted.

BLACK: CC 7 French Defense



Position after White's 6th move

1 e4 e6(0/0) 2 d4 d5(0/0) 3 Nc3 Nf6(0/0) 4 Bg5 Be7(0/0) 5 e5 Ne4!? (9/9) Again CC selects a dubious variation as soon as its opening "book" ends. 6 Bxe7 . . .Already Black is faced with a critical decision.

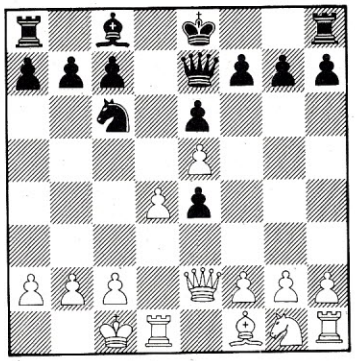
6 . . .Qxe7?!(3/12) Wrong. Black should play 6 . . .Nxc3, after which 7 Qg4 Qxe7 8 Qxg7 Qb4! leads to difficult tactical complications which ultimately result in an advantage for White, but one that has to be earned by hard thinking.

7 Nxe4 dxe4(3/15) 8 Qe2 . . .

Now White has a clear advantage and no problems, the e4 Pawn being very vulnerable.

8 . . .Nc6?(7/22) Here the reasonable moves are 8 . . .Nd7 and 8 . . .b6, taking advantage of the tactical trick 9 Qxe4? Qb4+.

9 O-O-O . . . Now White threatens to capture the Pawn.



9 . . .Qh4??(6.5/28.5) There was clearly no way to hold the Pawn, and it's easy (for humans) to see that this attempt is futile, merely advancing White's development. CC now treats us to repeated examples of the "horizon effect", making objectively bad moves which push the actual loss of material beyond its horizon, although anybody but a computer could see that the loss remains inevitable.

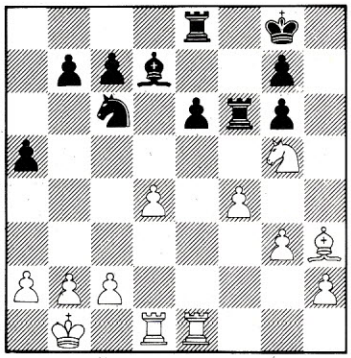
10 g3 Qg5+(6.5/35) 11 Kb1 f5?(10/45) CC orginally had expected to play . . .Qg6 here, but now its advancing horizon reveals that 12 Bg2 wins the Pawn. It plays this obviously bad move with the expectation 12 exf6 Qxf6 13 Qxe4 Qxf2 14 Bg2 (for example) and since White can't actually capture anything on his 14th move, CC concludes that this avoids losing material.

12 exf6 Qxf6 (6.5/51.5) 13 Qxe4 O-O(4.5/56) CC's horizon has now advanced and it can see that after 13 . . .Qxf2? it would be utterly destroyed by 14 d5.

14 f4 Qg6?(7/63) CC seems to have no objection to doubled Pawns.

15 Qxg6 hxg6(3.5/66.5) 16 Bg2 a5?(3.5/70) Again CC sees no good plan, so it advances a Pawn. There really was no good plan — Black is totally busted.

17 Nf3 Bd7(3.5/73.5) 18 Ng5 Rae8(5.5/79) 19 Rhe1 Rf6(7.5/86.5) 20 Bh3 . . .Now the threat of 21 d5 is very difficult to meet.



20 . . .Nb4?(4.5/91) The best chance was 20 . . .Nd8.

21 c4! . . . With the simple threat 22 a3.

21 . . .c6(8.5/99.5) 22 a3 Na6(3.5/103) 23 b3 . . .CC is completely tied up and unable to attempt anything, so why allow the possibility of . . .a4?

23 . . .b5?(3/106) Allowing the breakthrough that White has been playing for, and which CC played . . .c6 to prevent.

24 cxb5 cxb5(4/110) 25 d5 Nc5?(5/115) CC obviously should play . . .Nc7.

26 b4 . . .Now White wins more material.

26 . . .axb4(5/120) 27 axb4 Na4(5/125) 28 Rc1 . . .CC's clumsy tactical threats are easily evaded.

28 . . .Rc8?!(5/130) 29 Rxc8+ Bxc8 (1/131)

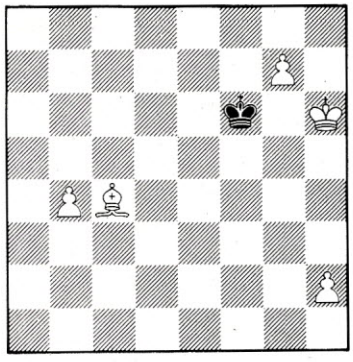
30 Rc1 Rf8??(2/133) Better, of course, was . . .Nb6. The reason is six plies ahead, so CC doesn't see it.

31 Rxc8! Rxc8(.5/133.5) 32 Bxe6+ Kh8? (.5/134) At this point CC began to play each move in a few seconds.

33 Bxc8 Nc3+ 34 Kb2 Nxd5 35 Kb3 Nc7

36 Ne6 Nxe6 37 Bxe6 Kh7 38 g4 Kh6 39 Bf7 g5 40 f5 Kh7 41 Ke5 Kh6

With the Black King in jail, White's task is simple.
42 Kd4 Kh7 43 Ke5 Kh6 44 Kd6 Kh7 45 Ke7 Kh8 46 f6 Kh7 47 Bh5 gxf6 48 Kxf6 Kh6 49 Be8 Kh7 50 Kxg5 Kg7 51 Bxb5 Kf7 52 Kh6 Kf6 53 g5+ Kf5? 54 g6 Kf6 55 g7 Kf7 56 Bc4+ Kf6



It is easy to appreciate that there's hardly any glory in Queening the Pawn and prosaically mating CC. As anyone who has read the famous prisoner episode in *Huckleberry Finn* knows, the remedy is to introduce some unnecessary complications — such as 57 g8(N)+ . . .!! Now, if White ignores his Pawns the task is difficult enough to be interesting, as more than one player (including an opponent of mine) has discovered to his embarrassment during a tournament game.
57. . .Kf5 58 Kh5 Ke5 59 Kg5 Kd4
CC doesn't put up the best defense.
60 Be2 Kc3 61 Kf5 Kxb4 62 Ke5 Kc3 63 Kd5 Kc2 64 Kd4 Kb3 65 Ne7 Kc2 66 Nd5 Kc1 67 Kc3 Kb1 68 Nb4 Ka1
Now the King is cornered, but the mate is only possible when the corner square is the same color as the Bishop, so CC's King must go for a further walk.
69 Bc4 Kb1 70 Nc2 Kc1 71 Ba2 Kd1 72 Nd4 Ke1 73 Kd3 Kf2 74 Bd5 Ke1
Here the Pawn at h2 simplifies matters by denying g3 to the King. Were it absent, White would have had to play 73 Bd5 Kf2 74 Nf5. Now, of course, it's easy.
75 Bf3 Kf2 76 Ke4 Kg1 77 Kf4 Kxh2 78 Kg4 Kg1 79 Kg3 Kf1 80 Nc2 Kg1 81 Be2 Kh1 82 Ne1 Kg1 83 Nf3+ Kh1 84 Ng5
1 — 0

David Welsh's apparent objective in staging this one-on-one "tournament" has not been to discourage the current crop of chess-playing devices but rather to encourage their improvement. It is his opinion that stronger-playing programs — an 1800-level machine for example — would find a ready and increasing market among the hordes of chess players in the world. His opinion is shared by most chess players. — ed.

"Chess Challenger is Fun"

Attorney John Paul Shaby, of 2321 Cloy Avenue, Venice, CA 90291, relates his own pleasant experiences with Challenger in the following letter:

"It has been my intention to write a few lines regarding the Chess Challenger series of chess playing microcomputers. Dale J. Shaw seems to have written an article which pretty well parallels what I would have said. But more needs to be penned so that your readers aren't left with an improper view of the Chess Challenger series.

"First: the statement that the early Chess Challenger Level 3 machine is an idiot may be true. But it has a redeeming feature that was not mentioned. It does not pick random moves and always makes the same moves in every game. This leads to the development of chess puzzles which can prove very interesting to solve. For example, force checkmate in eight moves of the White pieces in level 3. It can be done and I discovered how to do it by accident. For the more devoted, try removing your queen and forcing mate in 16 moves! Perhaps it can be done in less, but I have not found the way. The point is that the only machine which is capable of developing these puzzles is the Chess Challenger Three as it does not vary its response from game to game!

"As Mr. Shaw points out, Chess Challenger 10 and 7 had some problems and certainly did not play a strong game. But what was not said was that they did play a fair game at the Postal Chess Level. The only problem was that you had to wait a long time to make a move. Chess Challenger 10 at Level 6 would find solutions to mate-in-two's in about one hour, sometimes much less; infrequently much longer.

"But my main point in this note is to mention the countless hours of fun I have had with the new Chess Challenger Infinite Level microcomputer. For example, it solved the Mate-Rater problem 35 in 65 seconds on Level 5. From the table, it probably has a rating of 1712 to 1745, but I have put many mate-in-two puzzles to the machine, and most are solved in a similarly short time. Bearing in mind that Chess Challenger 10 Level would solve two-move mate problems in one hour, more or less, without fail, and Chess Challenger Infinite Level solves them in one minute, more or less, without fail, we see the vast improvements that are being made in the microcomputer. These improvements serve to make the Infinite Level microcomputer a significant opponent, even at the lower levels.

"I have undertaken by experiment to determine just how powerful the microcomputer really is. From my experience, it will not solve three-move mate problems at the lower levels, but will solve them at level 9 sometimes and almost always at level 'H', and without too long a wait, (no longer than 15 to 20 minutes.) When it does fail to find the checkmate, it always makes a good alternate move. Going to four-move checkmates, the machine appears to labor at Level 'H', sometimes for hours and does not always come up with the correct checkmating-move sequence. (I must add that a four-move mate problem would be four moves for White and Three for Black) I have tried several mating sequences beyond four moves for white, but the computer has not solved any of them, but in each case, it did make a good alternate move.

"Perhaps the one great difference that I have noted among the three predecessor Chess Challenger models and the Infinite Level machine is that there is no quick way to win. There seem to be no glaring flaws in the programs and time responses at all levels but Infinite have been reduced to the point where an enjoyable game may be played at any level!"

COMPUTER GAMES OF OTHER SORTS

("Intelligent" Computer games welcomed by this department. Address all correspondence to COMPUTER GAMES DEPARTMENT, Personal Computing.)

A Micro-GO Test Game

Last month's column heralded a new GO program for the microcomputer written by Prof. Hal Muller of Toronto, Canada, teacher of computer science and mathematics. The program, written in BASIC for an 8K PET, was reduced to a 9x9 grid but otherwise follows the official rules and logic of GO, according to its author. Recently, Dr. Shein Wang, of Guelph University's (Canada) Computer Science Institute, obtained a new Muller cassette and ran it through his micro. Following is his description of this first microcomputer GO program together with his game comments. The progress of the game, as well as the analysis, are shown graphically in both the "Game-Moves" and the "Annotation Figure."

Comments on Muller's GO Program

BY DR. SHEIN WANG

(Moves are shown in sequence and Black goes first.)

1) If, instead of 6, White follows the sequence of "Annotation Fig." 1, the game ends in a win for Black. This sequence is too simple. It is thus good for Black (the weaker player) and bad for White.
2) Black 7 invites the cut of White 8 and makes a complicated game. He should follow the sequence of "Annotation Fig." 2, where each side is breaking the stronghold of the other, leaving the game strongly in Black's favor.
3) To simplify the game, Black 11 should play at A in "Move-Diagram" 1. Then he will get to play at either B or C. If White takes C and Black B, Black's position is similar to that of "Annotation Fig." 1. If White takes B and Black C, Black's position is then almost as good as that of "Annotation Fig." 2, except for the captured stone 7 which makes White's area a little larger. This move is much harder than "Annotated Fig." 2, so Black should follow that sequence in the first place.
4) Black 13 should play at 15. White 14 should play at 17. Black 15 should play at 16. White 16 should play at 17. These are better because Black can kill the White group in the corner following the sequences of "Annotation Figs." 3 and 4. White overlooked this possibility during the game.
5) White now saw this possibility and played 20, thus making sure of winning the game.
6) Black 21 attacks from behind the enemy front. It is usually risky and should be avoided by all but those who know what they are doing. Instead he should play at 22 and follow the sequence of "Annotation Fig." 4, this is a common variation for the corner or on the side. The sequence looks complicated but actually it is very simple and powerful. It is known to all dan ranked players.
7) Black 23 is good, but 25 is not necessary. At this point Muller's Micro-Go was trying to attack the corner White group. That group, however, is very safe.
8) If White skips 34, Black can cut at A and wipe White out. Try it yourself and see what happens after Black A. This sequence is not valid if white 30 is not there. Thus if White doesn't want move 34 he shouldn't take 30.
9) Black 39 should play at 40 to protect his group. After White played at 40 the Black group is dead and we called the game.

I haven't had enough time to learn more about Muller's Micro-GO Program so I am making comments based on the one game we played. Next time I will give it a few handicap stones and see how it does in such circumstances. I will be getting a TRS-80 (16K, Level II BASIC) myself shortly, so maybe I will have my own Micro-GO in the not too distant future to give Muller a challenge.

It is my belief that the beginning GO player should first learn to protect his groups. He is usually given 9 or more handicap stones against a dan player and should try to protect most of them.

Diagram 1
(MOVES 1-10)

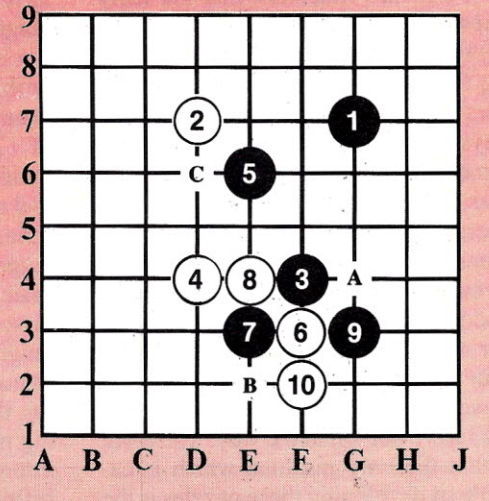


Figure 1
"ANNOTATION"

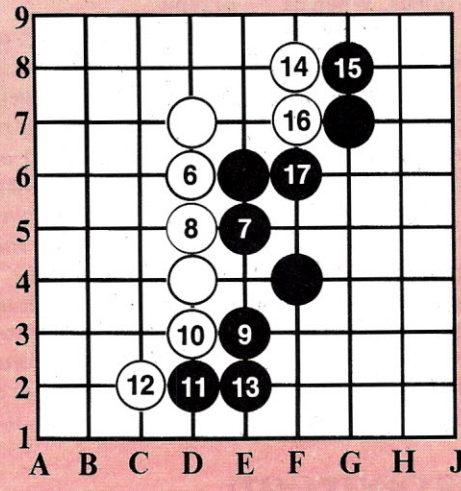


Figure 2
"ANNOTATION"

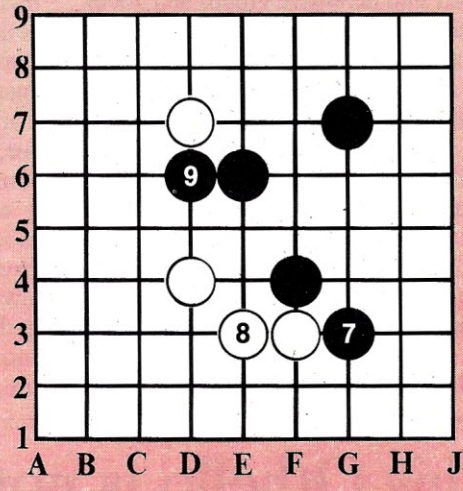


Figure 3
"ANNOTATION"
23 same as 17
24 same as 19
(see "comments")

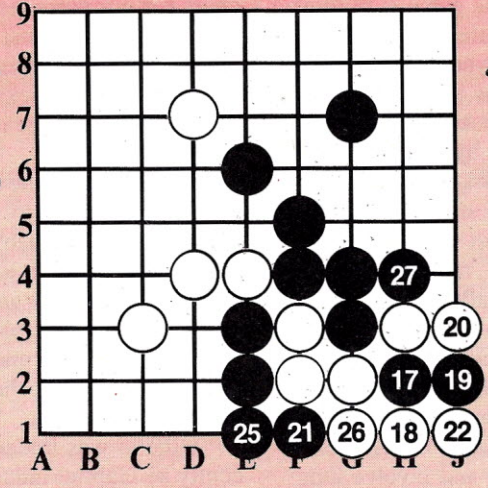


Figure 4
"ANNOTATION"

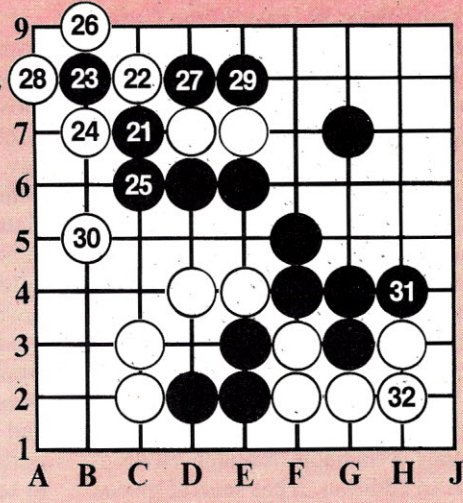


Diagram 2
(MOVES 11-20)

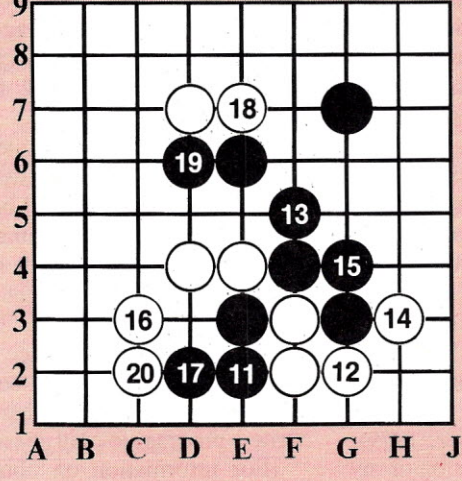
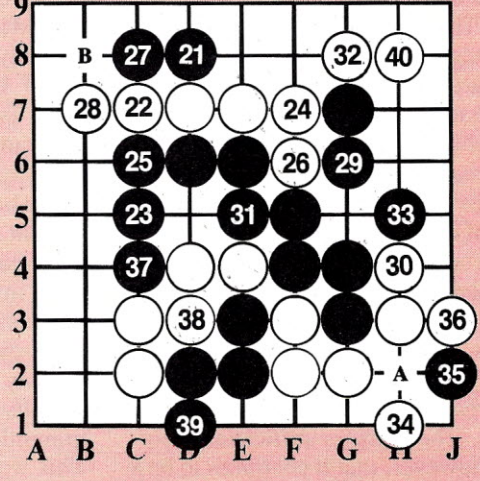


Diagram 3
"GAME-MOVES"
(MOVES: 21-40)



He does so by learning to link these stones into defensive groups and not to let enemy stones come in. At this early stage of learning all he needs to know is that if his group controls a large enough territory the group will live. He really has no need to know how to make two explicit eyes or how to go after enemy groups.

It is a generally accepted theory that if a beginner can protect most of his nine handicap stones against 1 Dan, he would be at the 9 Kyu level. Then he can start to learn about making two explicit eyes and take a little more chances with his men, and will need less and less handicap stones. When he gets quite good, say 1 or 2 Kyu, he can start to find out how to attack his enemy. It is my belief that if he tries to learn these techniques in any other order, he would be overwhelmed by the complexity of the game and will stay at a weak level much longer than he should. The fact that most of the GO programs are playing at 10 Kyu or lower probably points to their weakness in this respect. Namely, they probably know a little about everything but are not good at the very basics that could take them to a much stronger level of playing.

(Dr. Shein Wang, a rated GO player himself, directs the GOMOKU tournaments at Guelph University. GOMOKU, a close relative of GO, is easily programmed on the microcomputer and anyone interested in writing a program and joining the tournament should respond to the GOMOKU announcement in the Computer-chess Classified Ads section. Part II of Zobrist's GO program, which was to have been a continuation of January's Part I, will appear in a later issue.)

This Othello is not Shakespearean

Professor Peter W. Frey of the Cresap Neuroscience Laboratory, Northwestern University, 2021 Sheridan Road, Evanston, IL 60201, recently sent along a letter describing his new Othello program:

"As a psychologist, I am interested in the cognitive processes used by humans to play complex board games. There has been a reasonable amount of research on human chess skill. It is of considerable interest to determine if human skill in other complex games is similar in organizational characteristics to that in chess. For this reason, Othello provides a valuable research environment. In addition, it has several special advantages. Othello can be easily programmed on a personal computer. The machine can select moves rapidly (5 to 10 seconds each) and the level of play can be adjusted from medium to very good. The game also has the conceptual advantage that the best playing strategies are not obvious and in fact, most people start with a move selection strategy which is counterproductive. For this reason, one can easily infer changes in cognitive analysis on the basis of dramatic changes in the type of moves selected as players become more experienced. Because Othello is less complex than Chess or GO, it is possible for a new player to learn the rules quickly and to show fairly rapid improvement in skill during the first 10 games. The game is sufficiently complex, however, that it continues to be a challenge even for very experienced players.

"The object of the game is to finish with more pieces on the board than your opponent. Most players initially select moves which flip as many of the opponent's pieces as possible. This strategy is also used by the computer Othello program marketed by the Mad Hatter group. Such strategy is a very poor one and almost always leads to defeat. For example, my program at its lowest skill level totally demolishes the Mad Hatter program. (I understand that Apple also has an Othello program as does Compucolor, But I have not yet had a chance to play them.) The important strategic ideas in Othello relate to territorial control and involve long-range planning. My program emphasizes pattern analysis in its move selection and competes well against all comers.

"Because an Othello game is usually played in 20 to 30 minutes, my program has played hundreds of games on a 16K Level II TRS-80. As far as I know, there is no system for rating Othello programs. I am presently working with my students to establish skill levels based on the player's knowledge of important strategic ideas. We are developing a computerized technique to assess this information directly from the players game scores. This is an interesting project all by itself.

"My program represents about 4 months of intensive study and programming (Spring & Summer, 1979). This work is a natural extension of my activities in computer chess. In many respects, the game is more useful than chess for our purposes because skillful play depends almost exclusively on conceptual knowledge. One cannot win by slick tactical tricks as in chess. In this respect the game is more similar to Go than to chess.

"I do not know the number of possible games in Othello. It has to be less than 60! and is probably in the range of 10^{50}. The number is certainly large enough to eliminate any hope of developing an unbeatable sequence of moves. In fact, no one seems to know whether the player who moves first has an advantage.

"Othello was trademarked quite recently by Gabriel Industries but a game with almost identical rules was very popular in England during the 1890s under the name of 'Reversi'. My library research indicates that players during that time employed very sophisticated strategies. A colleague of mine also reports that a game very similar to Othello has been played for several hundred years in Hungary.

"If an Othello tournament can be staged for programs written for personal computers, I would be happy to see my program pitted against others. A tournament might generate a lot of interest in Othello and might encourage others to write programs. This would be an interesting challenge for young programmers and would be considerably more manageable than trying to write a program to play chess or GO."

(For information on obtaining this new Othello program, see the Classified Ads section in Computer Chess.)

Testing Computer Responses

BY THOMAS THROOP

This month I am focusing on one deal as bid and played by "Bridge Challenger" of Fidelity Electronics, and will compare play to that of my own bridge playing program. Then I shall discuss two more deals as bid and played by Jim Hilger's bridge program for the APPLE II. I will also comment on letters received from two readers. Finally, I'll mention a standardized bridge dealing sequence which I have developed for the Duisman program.

New readers, of this column, who are interested in the characteristics of Fidelity's Bridge Challenger, are referred to earlier columns (especially the July, September, and December columns of last year, as well as last month's column.) As discussed in those columns, "Bridge Challenger" will bid and play one, two, three or even all four hands while human players bid and play the remaining hands.

The Bridge Challenger deal mentioned above is as follows:

COMPUTER
NORTH
(Dummy)
♠S 74
♥H1072
♦D QJ108
♣C A743

WEST	EAST
♠S A95	♠S 83
♥H KQJ653	♥H 94
♦D 95	♦D A6432
♣C K8	♣C J1095

COMPUTER
SOUTH
(Declarer)
♠S KQJ1062
♥H A8
♦D K7
♣C Q62

With South the dealer, and Bridge Challenger playing the N-S cards, the two bidding sequences by Challenger, (depending on whether or not West enters the bidding), are as follows:

BIDDING — 1

South	West	North	East
1S	Pass	1N	Pass
3S	Pass	Pass	Pass

BIDDING — 2

South	West	North	East
1S	2H	Pass	Pass
2S	Pass	Pass	Pass

Bridge Challenger correctly opens 1 spade with the South hand. If West elects to pass, Challenger responds 1 no-trump with North's hand, rebids 3 spades after East passes, and passes with the North hand for a final contract of 3 spades. If West elects to overcall 2 hearts as shown or to make a takeout double, the Challenger passes with North's hand and rebids 2 spades with the South hand for the final contract.

Does Bridge Challenger know how to play this hand properly? Well, it does and it doesn't, as you will see. Assume that West finds the normal lead of the king of hearts. Challenger wins with South's ace and correctly leads a spade honor. The spade king is won by West with the ace, who cashes the queen of hearts and continues with the jack. The Challenger trumps this with the 10 of spades, overtrumping East's 8 of spades. (East's ruff with the spade 8 is an attempt to promote another trump winner for West and, besides, the spade 8 is not much good to East.)

After drawing trumps, the Challenger now decides to set up the diamond suit by correctly leading South's king of diamonds, which is the correct play.

If East now wins with the ace of diamonds, then Challenger will be able to take the rest of the tricks, discarding South's losing clubs on established diamond winners. Suppose, however, that as East you decide not to take South's king of diamonds but elect to play a low diamond! Now the Challenger becomes confused and leads South's queen of clubs!? The diamond suit should have been continued. Furthermore, if the club suit were to be attacked, the queen is the wrong card to play in the indirect finesse situation.

As illustrated in tableau #1 after leading the queen of clubs at trick 8, Challenger loses two tricks in the club suit. The club queen is covered by West's king, which Challenger then wins with the ace. Now Challenger returns to the diamond suit — but too late! After East wins the ace of diamonds he cashes two club tricks. The result is that Challenger will win only eight tricks, losing 1 spade, 1 heart, 1 diamond, and two clubs. When I gave the same deal to my own bridge playing program, the play was the same for the first seven tricks. However, at trick 8 my program continued diamonds by leading the 7 from South! The final result was that my program won ten tricks, losing only 1 spade, 1 heart, and 1 diamond. South's losing clubs were discarded on dummy's long diamonds.

I was curious as to why Challenger would bid North's hand if there was one more spade and N-S were playing four card majors or, in other words, not playing the 5-card major convention. I gave North four different "test" hands, as shown, to see what the responses would be to South's 1 spade opening bid.

TABLEAU NO. 1

	W	N	E	S
Trick 1	KH	2H	9H	AH
2	AS	4S	3S	KS
3	QH	7H	4H	8H
4	JH	10H	8S	10S
5	5S	7S	3D	QS
6	9S	3C	2D	JS
7	9D	8D	4D	KD
8	KC	AC	5C	QC?
9	5D	QD	AD	7D
10	4C	8C	JC	2C
11	3H	7C	10C	6C
12	5H	10D	6D	2S
13	6H	JD	9C	6S

Tricks N-S (Challenger): 8 **Tricks E-W: 5**

West and East are you: North and South are Challenger

"TEST" HAND 1:	**S 743**
(North)	**H 1072**
	D QJ108
	C A74
"TEST" HAND 2:	**S A43**
(North)	**H 73**
	D Q1084
	C K743
"TEST" HAND 3:	**S A43**
(North)	**H 7**
	D J10842
	C K743
"TEST" HAND 4:	**S A43**
(North)	**H —**
	D Q10842
	C Q8743

On hand 1, if South opens 1 spade and if West passes, Challenger will bid 1 no-trump as opposed to raising to 2 spades. This is a reasonable response with the 3-3-4-3 distribution. If West overcalls 2 hearts, Challenger passes, despite North's three trumps and seven points. Two spades would be a better bid.

On hands 2, 3, and 4, if South opens 1 spade and West again passes, Challenger will again bid 1 no-trump. On each of these hands a raise to 2 spades would be a much better bid, particularly with hands 3 and 4. If West overcalls 2 hearts, Challenger passes with all three hands, despite holding three card trump support with 10-11 points. These hands certainly justify some sort of action, at least a raise to 2 spades.

As mentioned in the January column, I expect to participate with Fidelity's Bridge Challenger at the Greater New York Bridge Association Regional Tournament in December. Each program will be given several deals to play which it will be seeing for the first time. I am looking forward to this competition, and will report the results of this match in next month's column.

The August 1979 column and last month's column described Jim Hilger's new bridge routines. Jim has written a bidding program and a defensive playing program. These two programs, when linked by smaller routines, form a bridge system he has named "TRIK 1.0". During the bidding you bid the South hand, while the computer bids the West, North, and East hands. At the conclusion of the bidding, if the final contract is a N-S contract, then you may play the N-S cards while the computer program defends. Jim's bridge software is written for the APPLE II computer.

On the first deal shown Jim became the declarer at 3 hearts. The computer's bidding for the other three hands is quite reasonable. As West, the computer has a difficult choice for an opening lead and selects the 4 of diamonds. Jim won with his 7 of diamonds, drew two rounds of trump, and then attempted to set up the club suit with two ruffs in dummy. He should have led a low club at trick 5 rather than the queen in case the enemy clubs were divided 4-2 (as they were) with a doubleton king. The computer's defense was fine, the program eventually winning one trick in each suit (see Tableau #2.)

NORTH
♠ 10 9 8 7 3
♥ A 9 8 6
♦ K 10 6
♣ 7

WEST
♠ A Q 4
♥ Q J
♦ A J 8 4
♣ K J 9 5

EAST
♠ K J 6 5 2
♥ 7 5 4
♦ 5 3 2
♣ 6 4

SOUTH
♠
♥ K 10 3 2
♦ Q 9 7
♣ A Q 10 8 3 2

"Hilger Deal" No. 1
(South dealt.)
BIDDING:
(You)

South	West	North	East
1C	Double	1S	Pass
2C	Pass	2H	Pass
3H	Pass	Pass	Pass

On the deal No. 2, after East dealt and passed Jim opened 1 heart with the South hand. The computer doubled as West, redoubled as North, and bid 2 diamonds as East. Jim now bid 3 clubs. The computer then bid 3 spades as West, 4 clubs as North, and 4 diamonds as East. Now Jim bid 5 clubs, which was the final contract. The bidding by the computer is again quite reasonable.

As West, the computer program opens the 3 of diamonds. The ace would be a better choice. The program wins the trick with the king of diamonds in the East hand and returns the singleton 4 of spades. Jim played his king, losing to West's ace. There are no more tricks to be won with the E-W cards (Tableau #3) and the computer's defense is as good as any.

TABLEAU NO. 2

	W	N	E	S
Trick 1	4D	6D	2D	7D
2	JH	AH	4H	2H
3	QH	6H	5H	KH
4	5C	7C	4C	AC
5	KC	8H	6C	QC
6	4S	3S	2S	3H
7	JC	9H	5S	10C
8	AD	10D	3D	QD
9	9C	7S	6S	2C
10	AS	8S	JS	3C
11	8D	KD	5DC	9D
12	QS	9S	KS	10H
13	JD	10S	7H	8C

(Made. No overtricks.)
W and E are computer.

NORTH
♠ J 10 8 6 2
♥ 2
♦ 4
♣ A K Q 8 6 2

WEST
♠ A Q 9 7 5 3
♥ 9 6 4 3
♦ A J 3
♣

EAST
♠ 4
♥ Q 10 5
♦ K Q 10 8 7 6 2
♣ 9 4

SOUTH
♠ K
♥ A K J 8 7
♦ 9 5
♣ J 10 7 5 3

"Hilger Deal" No. 2
(East dealt.)
BIDDING
(You)

SOUTH	WEST	NORTH	EAST
			Pass
1H	Double	Redouble	2D
3C	3S	4C	4D
5C	Pass	Pass	Pass

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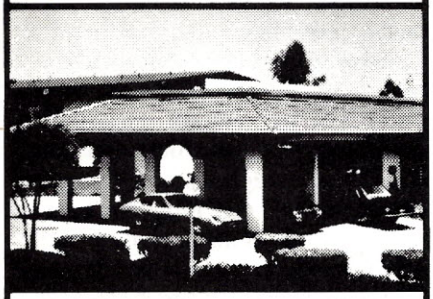

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COMPUTER BRIDGE

TABLEAU NO. 3

	W	N (Dummy)	E	S (You)
Trick 1	3D	4D	KD	5D
2	AS	2S	4S	KS
3	3S	JS	4C	5C
4	3H	AC	9C	3C
5	5S	6S	5H	JC
6	4H	2H	10H	AH
7	JD	2C	2D	9D
8	7S	8S	6D	7C
9	6H	10S	QH	KH
10	9H	KC	7D	7H
11	9S	QC	8D	10C
12	QS	8C	10D	8H
13	AD	6C	QD	JH

(Made. No overtricks)
W and E are computer.

A letter received from Paul H. Schneider, Jr., of Hasting, NB, states: "I have an Apple II, 48K with Disk II. I am interested in acquiring a bridge program or programs to run on my system, making use of my disk drive and Apple graphics, if possible. I would like to be able to generate deals and save them on disk for later recall. Do you know of a program which may fit the bill? My wife and I are rankest of amateurs, but we would like to use the Apple to develop a little more skill at playing." I have suggested to Paul that he purchase the Apple version of George Duisman's program and that he also contact Jim Hilger at 5315 17th Ave., Moline, IL 61265, regarding the availability of his bridge software described earlier.

I have a standardized dealing sequence for the PET, TRS-80, and APPLE versions of George Duisman's bridge program. The same deals are generated on all three machines from the same random number seeds. In the future, when I discuss a deal, I would like all of you to be able to generate the same deal from the same random number, (if you have any one of these three personal computers.) I shall be glad to incorporate this standardized dealing sequence into your version of the Duisman program, if you will kindly send me a cassette with a copy of your version, along with $3.00 to cover the return postage and a small amount of my time. My address is 8804 Chalon Drive, Bethesda, Md. 20034.

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CIRCLE 43

Software from Hayden

BY KEN MAZUR

Hayden Book Company, Inc., offers a variety of software packages for the TRS-80, Apple II and Pet, including games, application programs and home/hobby fare. Of the many programs available, let's look at *Sargon II; Batter Up!!!: A Microbaseball Game; General Mathematics; Engineering Mathematics;* and *Keynote* for the 16K Level II TRS-80.

At the top of the list in both challenge and intellectual enjoyment is *Sargon II* by Dan and Kathe Spracklen. If you like chess but cannot find an opponent whenever you have the time to play, purchase this program. For a TRS-80, *Sargon II* is the strongest microcomputer chess program around. There are tougher chess playing programs but you'll find them on stand-alone chess units or bigger computers.

As with many TRS-80 programs, the graphics leave something to be desired; at times it is hard determining which piece is where. A chessboard, set up to reflect the video display, makes the game easier to follow.

Sargon II has 7 levels of play with levels 0 (beginners) through 3 playing in tournament time. Each higher level of play increases the program's computation time and playing skill. As you exchange pieces and the number of men on the board decreases, the program does not take less time to make a move but rather increases the look-ahead. Level 0 gives an immediate response from the computer while Level 6 averages four hours for a machine move. A special hint mode operates at all levels except Level 0. The hints suggest good, but not necessarily the best, moves you can make against the machine.

With *Sargon II* you can play black or white, choose the level of play (a nice feature as you find yourself improving with practice), select to play a new game or preset the board to a particular situation through the use of the keyboard arrow keys.

Placing a piece in a square involves typing in a three-part code: the piece code, color and status. The status feature is handy; telling the computer whether a piece has moved ensures legal castling and pawn moves and lets the computer know for evaluation purposes whether a piece has ever been developed.

The program's documentation is good.

In all, *Sargon II* is an excellent way to sharpen your chess skills without suffering the comments of a gloating opponent. I was slaughtered (never mind the level) and thought the computer accepted my defeat in a dignified manner.

For baseball enthusiasts, *Batter Up* offers a combination of three graphic displays and a constantly updated scoreboard.

The first display features batter versus pitcher. Once a ball is pitched, the batter controls the timing of his swing; the later the bat is swung, the greater your batting power and the higher the probability of a longer hit or home run. When the bat is swung in the proper zone (there are four zones), and within the hitting range, the display indicates a possible single, double, triple or home run.

At this point, the second display shows a fielder's attempts to catch your hit. He randomly moves his glove for a catching average of 50%. The fielder turns his head to watch a homerun or successful hit go past him (a nice graphics touch).

Written in BASIC, *Batter Up* has good and bad points. BASIC is slower than machine language and you sometimes find yourself waiting for the graphics displays to be completely drawn before the action continues. The wait is short, however, and does lend an air of anticipation as to the success of your hit as determined on the second display. The major advantage of BASIC is the opportunity to use this program's techniques in your own games. A variety of different things take place in this game and you can learn useful techniques just by studying a listing on the display.

Hayden's "Mathematics in BASIC" tapes utilize a microcomputer's capabilities to perform various mathematical operations.

General Mathematics-1 is a practical working aid for professionals or a learning tool for students. In a home environment, the tape would probably find little use except as a programming resource where the program being written used one of the individual math operations offered on this tape.

GM-1 contains 15 programs run from a menu: log to any base, new coordinates (helpful when you want to convert data from one frame of reference to another); vector cross-products; vector scalar products; maximum/minimum locator; number rounder; dimension scalar; histogram; circle finder; Nth root of a number; normally distributed random numbers; and rational fractions.

With *Engineering Mathematics-1,* you have options for solving simultaneous equations, evaluations of a polynomial, solving quadratic equations, integration by Simpson's Rule, Newton-Raphson Roots, derivative of a function, factorial of a given number and extended factorial calculation.

For persons who deal with this level of mathematics, Hayden's documentation provides line numbers of the individual functions to incorporate them into your own programming. Either retype the math operation or use one of the merge programs available to put the math operations in your own program.

If you have any interest at all in music, try *Keynote,* Hayden's music synthesizing program.

Keynote allows you to hear any type of music in slow, medium or fast tempo across almost five octaves with notes and rests ranging from whole to 1/32 duration. The program permits songs of up to 1500 notes.

While certain basic information regarding musical notation is included in the program documentation to help you transcribe sheet music into keyboard input, the program assumes a general understanding of music in its written form.

The program is menu driven using the INKEY function and provides music

input through keyboard, music input from cassette, review and edit, the TRS-80 in concert and music output to cassette.

After loading the cassette, take advantage of the musical compositions provided in the machine language working file with the program. You must play the songs provided directly after loading as inputting your own material from the keyboard or a cassette tape wipes the prerecorded music from the file. The songs (three selections), demonstrate the versatility of the program as well as the maximum note capacity. The music that comes with the program cannot be accessed through the review and edit mode.

Using an external amplifier (I didn't try using the cassette recorder itself to hear the music) produces clear, lovely notes. The progam is worth its price just to hear the capabilities of the TRS-80 even if you do not enter any music yourself. For experimenters, there is a sample input exercise of a 51-note song.

Prices for the Hayden TRS-80 tapes are: Sargon II, $29.95; Batter Up, $10.95; General Mathematics-1 and Engineering Mathematics-1, $14.95 each; and Keynote, $9.95. Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662.

A Useful TRS-80 Utility

If you've ever had problems loading a cassette tape into your Level II TRS-80 or had a system tape go bad with no backup available, TRcopy by Data/Print may be the very thing you need.

With the program you can make copies of BASIC programs and machine language programs alike, as the system allows you to load any binary data into memory.

A machine language program, TRcopy resides in the lowest area of your RAM with tape data loaded into memory immediately following the system program. The size of your machine's memory will determine the maximum quantity of data you can load and copy as the copy system takes up some of the memory space. Maximum lengths of tapes that can be loaded and copied for the various memory sizes are: 4K, 1782; 16K, 14,070; 32K, 30,454; and 48K, 46,838.

Programs are loaded in their entirety but cannot be executed; the data is loaded exactly as input from the cassette with tape processing codes and all.

When you begin inputting from cassette, the screen fills with hexadecimal values and their ASCII representations where applicable. Up to 320 bytes of data can be displayed at one time and if a tape is longer, a second set of data overlays the first on the display. The data does not overlay itself in memory, however.

Once you load the program you wish to copy, you can verify the accuracy of the data by using a verification function similar to CLOAD? In this mode, each byte of data from the tape is checked against its counterpart in memory. If a piece of data doesn't match, an asterisk is displayed over the offending data.

After the data has been loaded and verified, you can make printed copies for analysis or reference by outputting the entire contents of the tape to a printer for hardcopy.

Another function of the TRcopy system allows you to output the data you have loaded into memory to tape; a BASIC program outputs as a BASIC program while a machine language program is copied as a machine language program. Copies can be verified the same way you checked the tape after loading it into your machine. You may make as many copies of a program as you wish as long as the program you have in machine memory has not been changed with the loading of a different tape.

Excellent documentation provided with the system leads you through several test programs. In addition to instructions on how to use the program, there is a great deal of information on how the system works, tape storage formats, conversion tables, instructions on the care and use of cassette recorders, common problems with tapes and a page on condensed instructions.

TRcopy would be valuable if you did nothing more with it than make backup copies of your favorite tapes but you can also use it to monitor new tapes to find the best recording level for proper loading.

TRcopy System, priced at $39.95, comes with system cassette and documentation from Data/Print Publishing, Dept. PC, Box 903, Fargo, ND 58017; (800) 437-4144 (toll-free).

— *Ken Mazur*

Common Programs for Pet, TRS-80

Some Common BASIC Programs by Lon Poole and Mary Borchers, originally published in book form for those who can use a variety of practical programs, is available in media.

If you have a Pet or TRS-80 Level II, you can purchase the programs on cassette ready to run on your computer. The programs are also available on disk for the Pet. Osborne/McGraw Hill, publishers of the software, have modified the printed versions of the programs so that they run optimally on the micros, conforming to each machine's BASIC syntax and video display. A copy of the book can be used for program descriptions and operating instructions.

The 76 programs cover a wide variety of personal finance, math, statistics and general interest topics.

Price for the cassette versions is $15, the book is $12.50, and the Pet disk is $22.50. Order from Osborne/McGraw Hill, 630 Bancroft Way, Dept. W19, Berkeley, CA 96710; (415 548-2805.

WHAT'S COMING UP

SYSTEMS

Remote Work Station Distributes Processing

A Remote Work Station for Digi-Log Systems' Microterm II desktop distributed processor, runs independently of its host but shares the host's triple-diskette file system to trim costs. The unit distributes the power and convenience of your system to other company departments, such as accounting and shipping, and gives you the flexibility to configure your system according to present and future needs.

The work station, an integrated desktop unit similar in appearance to the Microterm II, has microprocessor architecture with multi-tasking and concurrent operation capability. However, the host's 1 Mbytes of on-line, ISAM-supported file storage is shared by the work station. The work station's operating system and application programs are downline loaded from the host. File-resident user programs, developed at the host in Extended Business BASIC, are transferred to the work station under operator command and stored in its 64K byte memory.

The Remote Work Station can be located at virtually any distance from the host. Typically, short haul modems or modem eliminators are used with cable connection between the two units. This arrangement eliminates telephone company charges and facilitates equipment relocation, the company said. However, the unit can also communicate with its Microterm II host over common carrier telephone lines at transmission rates of up to 1200 characters per second (9600 bps).

The work station can support its own printer or share the host printer. The printer interface is Centronics compatible.

Available for immediate delivery, the Remote Work Station is priced at $3900. The company offers systems analyst support, nationwide third-party maintenance, a library of subroutines and development software. For more information contact Digi-Log Systems, Inc., Babylon Rd., Horsham, PA 19044; (215) 672-0800. *Circle No. 158*

8085 Microcomputer with Dual Floppies

The iPEX 8085, a new desk-top microcomputer, features built-in dual floppy disk storage.

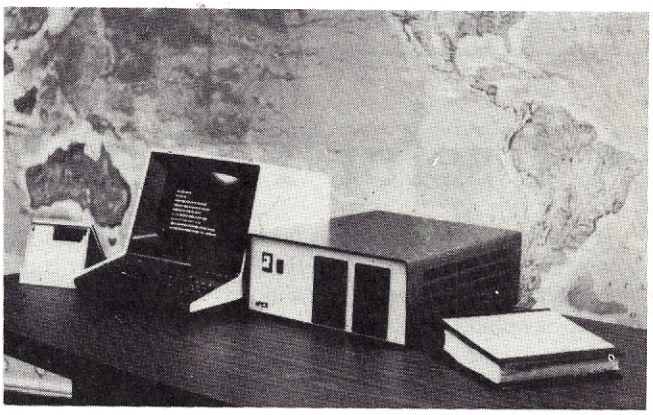
A single key stroke on your CRT terminal initiates the automatic start-up routine which seeks and locks onto any standard CRT baud rate from 110 to 9600 baud. Each location of the Random Access Memory (RAM) is automatically quick-tested while a sign-on message displays the installed memory size and indicates the Operating System is being auto-loaded. The loading completes in about 4 seconds and you can call up any applications or development programs on disk.

The standard system includes approximately 600K bytes of on-line disk storage capacity which can be expanded to over 1.2 megabytes. Similarly, the standard 32K byte RAM can be expanded to 56K bytes directly without using memory management schemes.

The Central Processing Unit is based on the 3MHz Intel 8085A microprocessor. The iPEX 8085 is fully compatible with 8080 software.

The unit is supplied complete with a Disk ExtendedBASIC package, a Disk Operating System, utilities software including a Debug package, and a 3K byte PROM Resident System Monitor.

Other software supported on the iPEX 8085 includes CP/M, CBASIC, Microsoft BASIC, FORTRAN-80, a Data Base Management package and the wide range of commercially available applications programs compatible with these languages and operating systems.



A user's and maintenance manual is supplied with each computer. Software documentation includes listings of the PROM Monitor and disk interfacing to allow customization of the system. The price of the iPEX 8085 is $3695. The price includes a universal power supply. Delivery time is 30 days. For more information, contact iPEX International, Inc., 16140 Valerio St., Van Nuys, CA 91406; (213) 781-0020. *Circle No. 142*

PERIPHERALS

Low-Profile Impact Printers

The IMP Series of low profile impact printers, styled for office or home, has been announced by Axiom Corporation.

The units, which stand 3½ inches high, can print 80, 96 or 132 columns of hard copy with a throughput of one line per second.

The IMP-1, which has friction feed, can make 3 copies on plain 8½-inch wide paper for word processing, and can handle teletype rolls as well. The IMP-2, in addition to friction feed, also provides tractor feed with tractors adjustable from 2½ inches to 9½ inches.

The 7×7 dot matrix has a standard 96 ASCII character set with special character sets available as an option; double width characters are provided for headlining or accenting. The IMP-2 can handle graphics under software control. Standard inputs include "Centronics" parallel and RS232C/20 mA serial to 1200 baud. 9600 baud serial is optional. Both models have a 512-character buffer with 2K characters

optional for fast screen dumps. The IMPs are 17.5 inches wide, 8.75 inches deep, 3.5 inches high and weigh 15 pounds.

The price for IMP-1 (friction feed) is $695; IMP-2 (both friction and tractor feed) is priced at $795. Delivery is stock to 60 days after receipt of order. For more information contact Axiom Corporation, 5932 San Fernando Rd., Glendale, CA 91202; (213) 245-9244. *Circle No. 121*

Intelligent Daisy Wheel Printer

With five built-in microprocessors, the HY-Q 1000—a letter-quality daisy wheel printer from XYMEC—eliminates the need for complex personal computer software, said the company. Microcomputer owners can plug any personal (or other) computer into a HY-Q 1000, which automatically converts simple codes into instructions for right justification, proportional spacing, automatic tabbing, bold and underlined letters, automatic columns, automatic title centering, automatic decimal point location and other commonly-used text formatting functions.

The printer has other features including "Quadra-Pitch" (10, 12 or 15 characters per inch, or proportional spacing); up to 198 characters per line; 100 printable characters in five languages (English, Italian, Spanish, French and German, available without changing the daisy wheel); and a choice of 21 typestyles in five colors. Another feature is reverse printing (white characters on a black background) which is useful for highlighting information.

The HY-Q 1000 can also function as an electronic typewriter. The typewriter, made by Olivetti Corp., provides a 224-character, two-line memory; a 1024-character, non-volatile memory for often-used phrases, margins and tabs;

automatic paper positioning; electronic margin reset; and a digital readout to show column position and lines to end of page.

The printer comes with a 3-month warranty. Maintenance is available at over 500 Olivetti service centers and dealers around the United States. Olivetti servicepersons can also easily replace the microprocessor board if necessary.

XYMEC's HY-Q 1000 intelligent printer, priced at $2495 retail, is available at computer stores or directly from the factory. Delivery is 60 days. For more information contact XYMEC, 17791 Skypark Circle "H", Irvine, CA 92714; (714) 557-8501. *Circle No. 125*

SIMUTEK PRESENTS

★ TRS-80 ★

.....GAMES.....

!!! WHOLESALE !!!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE ONE ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

GRAPHIC-TREK "2000" — This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprise to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players! ★ **INVASION WORG** — Time: 3099, Place: Earth's Solar System Mission: As general of Earth's forces, your job is to stop the Worg invasion and destroy their outposts on Mars, Venus, Saturn, Neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Neutrino Blasters! Worg Forces: Robots — Saucers — Disintegrators — Proton Destroyers! Multi level game lets you advance to a more complicated game as you get better! ★ **STAR WARS** — Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb, then escape via the only exit. This graphics game is really fun! May the Force be with you! ★ **SPACE TARGET** — Shoot at enemy Ships with your missiles. If they eject in a parachute, capture them — or if you're cruel, destroy them! Full graphics, real time game! ★ **SAUCERS** — This fast action graphics game has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE TWO ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

CHECKERS 2.1 — Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. ★ **POKER FACE** — The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match! (Plays 5 card draw). ★ **PSYCHIC** — Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for parties. ★ **TANGLE MANIA** — Try and force your opponent into an immobile position. But watch out, they're doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!) ★ **WORD SCRAMBLE** — This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles the word, then keeps track of wrong guesses.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE THREE ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

POETRY — This program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then the mood, and it does the rest! It has a 1000-word + vocabulary of nouns, verbs, adjectives and adverbs! ★ **ELECTRIC ARTIST** — Manual: draw, erase, move as well as, Auto: draw, erase and move. Uses graphics bits not bytes. Saves drawing on tape or disk! ★ **GALACTIC BATTLE** — The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time! ★ **WORD MANIA** — Can you guess the computer's words using your human intuitive and logical abilities? You'll need to, to beat the computer! ★ **AIR COMMAND** — Battle the Kamikaze pilots. Requires split second timing. This is a FAST action arcade game.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE FOUR ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

LIFE — This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, the computer does the rest! Program can be stopped and changes made! Watch it grow! ★ **SPACE LANDER** — This full graphics simulator lets you pick what planet, asteroid or moon you wish to land on! Has 3 skill levels that make it fun for everyone. ★ **GREED II** — Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy! ★ **THE PHARAOH** — Rule the ancient city of Alexandria! Buy or sell land. Keep your people from revolting! Stop the rampaging rats. Requires a true political personality to become good! ★ **ROBOT HUNTER** — A group of renegade robots have escaped and are spotted in an old ghost town on Mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE FIVE ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SUPER HORSERACE — Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 9 people can play! Uses real odds but has that element of chance you see in real life! Keeps track of everyone's winnings and losses. This is one of the few computer simulations that can actually get a room of people cheering! ★ **MAZE MOUSE** — The mouse with a mind! The computer generates random mazes of whatever size you specify, then searches for a way out! The second time, he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouses! ★ **AMOEBA KILLER** — You command a one man submarine that has been shrunken to the size of bacteria in this exciting graphic adventure! Injected into the president's bloodstream, your mission is to destroy the deadly amoeba infection ravaging his body! ★ **LOGIC** — This popular game is based on Mastermind but utilizes tactics that make it more exciting and challenging — has 2 levels of play to make it fun for everyone. ★ **SUBMARINER** — Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE SIX ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

20 HOME FINANCIAL PROGRAMS — Figures amortization, annuities, depreciation rates, interest tables, earned interest on savings and much, much more. These programs will get used again and again. A must for the conscientious, inflation minded person.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ PACKAGE SEVEN ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

BACKGAMMON 5.0 — 2 different skill levels make this game a challenge to average or advanced players. (Not recommended for beginners). Looks for best possible move to beat you! FANTASTIC GRAPHICS. Plays doubles and uses international rules. ★ **SPEED READING** — Increases your reading speed. Also checks for comprehension of material. Great for teenagers and adults to improve reading skills. ★ **PT 109** — Drop depth charges on moving subs. Lower depths get higher points in this fast action graphics game. ★ **YAHTZEE** — Play Yahtzee with the computer. This popular game is even more fun and challenging against a TRS-80! ★ **WALL STREET** — Can you turn your $50,000 into a million dollars? That's the object of this great game. Simulates an actual stock market!

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CIRCLE 17

SOFTWARE

Music Board Software

Software support for the Newtech Model 6 music board is available on CP/M compatible disks.

The MV80 Multivoice Music Interpreter allows you to enter four-voice music in a simple notation. The waveforms for each voice can be individually controlled to create the impression of a quartet made up of different instruments. MV80 requires CBASIC 2 and a 40K or larger 8080, Z-80 or 8085 CP/M system.

MV80 is available on 8'' single density IBM, Micropolis Mod II and Northstar 5'' CP/M compatible disks for $29.95 including a 30-page manual that contains complete program listings and is available separately for $19.95. The S-100 bus compatible Model 6 music board, $59.95 assembled and tested, is available from local computer stores. For more information contact Newtech Computer Systems, Inc., 230 Clinton Street, Brooklyn, NY 11201. *Circle No. 136*

Format Program Listings for TRS-80

Data Associate's Pager8 will provide program listings in a paged format for manuals, publications and editing. Written for a TRS-80, it runs on a single disk system with 32K memory.

Pager8 automatically reads any named BASIC program saved in ASCII form on disk and prints it on the line printer. Long program lines that would run off the page in normal listing can be listed in easily readable form. Each page of the listing has the program name printed as a heading, along with the page number. The left border is indented to permit binding.

The page length (lines), lines per page, characters per line and left border size can be changed within the program through prompting instructions. The program is self documenting, with built-in checks for entry errors. A number of utilities are built in. Options permit listing on the screen only, or with a hard copy on the printer also. At the end of the program listing, a summary is printed of the program name, the time, the elapsed time for the listing, plus the number of bytes, lines and pages in the listing.

Pager8 comes with an instructional manual plus three copies on a cassette that can be loaded onto disk. The cost is $19.95. For more information contact Data Associates, Box 882, Framingham, MA 01701. *Circle No. 160*

1802 Capability on Apple II

Cosapple, an 1802 simulator and debug package designed to run on the Apple II, is being offered by Dann McCreary. Any 16K or larger Apple II can run programs coded in 1802 machine language and can be used as a development aid for checking out modest 1802 applications.

Cosapple is useful in learning how an 1802 works; like having a ''window'' on the inner world of the 1802, the company said. All of the 1802's internal registers are labeled and displayed on the Apple's screen. A touch of the space bar moves Cosapple a step at a time through an 1802 program as you observe data changing in affected registers. You can watch data flow when you initiate Cosapple's trace mode, and vary the trace speed with the twist of a paddle. You can modify any register and see the results, set up as many as 8 breakpoints, or change the course of your program by invoking an interrupt or modifying a flag. Cosapple puts you in control of every facet of 1802 operation. In addition, Cosapple lets you call 6502 subroutines directly from your 1802 program and lets you embed 1802 code in the middle of your 6502 programs, the company added.

The complete Cosapple package is in three parts: the Cosapple Manual—an Integer BASIC program, provides documentation; a machine language interpreter of 1802 code; and Cosycat, an 1802 game program with a commented listing which demonstrates Cosapple's features. A pocket-sized Cosapple Ready Reference Card is also included.

Cosapple, supplied on cassette tape and shipped first class, is priced at $20 plus $1.50 shipping and handling. California residents add 6% sales tax. For more information contact Dann McCreary, Box 16435-T, San Diego, CA 92116; (714) 281-5758. *Circle No. 110*

TRS-80 Payroll Program

Small businesses may utilize Data Train Inc.'s Payroll for their dual mini-disk, 32K, TRS-80 Mod I business system. Payroll is user-oriented, maintainable and self-installable, the company said.

Payroll runs in all states with state, federal and local taxes, and employee records under your setup and maintenance. Other features include: monthly, quarterly, yearly pay, and hour records; control of pay categories and taxing methods; user oriented menus and operations; recording of hand-written (after the fact) checks; departmental reporting; 50 employees per mini-diskette; a picture-like report writer for maintenance of the W-2 and 941, plus user design of special reports for departments, unions, earnings, and tax. Fixed (programmed) reports include: checks and/or stubs, register, journal, employee list/records, mailing labels and others.

Non-technical operator's reference manuals are provided for instruction and reference. Price (user license) is $235. For more information contact Data Train, Inc., 840 NW 6th Street, Suite 3, Grants Pass, OR 97526; (503) 476-1467. *Circle No. 149*

Data Base Management, Utility, for TRS-80

The Alternate Source offers a utility program that adds features to a TRS-80 plus information, storage and retrieval management for systems operating under TRSDOS.

DVR is a machine language utility which adds both features and patches to your TRS-80.

Using approximately 500 bytes, the program adds a re-

peating key function; directs screen output to screen and printer; permits you to run programs using LPRINT without hanging up the system; provides a keybounce fix; allows users to LPRINT space compression codes (CHR$(191) through (CHR$(255); allows keyboard input of regular lower/upper case characters; and generates a space, if required, after each LPRINT.

ISAR is a data base management system designed to accommodate personal applications for persons desiring to use TRSDOS random file structures. The system has a modular design that utilizes the limited TRS-80 chaining techniques; you only have as much of the program in memory as necessary to perform any given function. The system also facilitates modification and expansion of the ISAR system to include other data manipulation functions. Code is in Disk BASIC using structured techniques.

The primary ISAR system consists of six modules which allow you to create any number of new files; accurately define all elements within each file, and manipulate each file to your needs using a menu of features. Each file or portion of a file can be sorted using BASIC Shell-Metzer sort.

DVR comes on cassette with instructions for creating a disk file (if desired). Specify DOS or Level II and memory size. All orders are shipped for 16K Level II unless otherwise requested. DVR is priced at $9.95, plus 75¢ postage.

The ISAR package includes complete source listing, documentation, potential recovery techniques in the event of a system failure and suggested personal applications with sample implementation. ISAR is available on cassette for $13.95 or diskette for $16.95.

For more information, contact The Alternate Source, 1806 Ada Street, Lansing, MI, 48910; (517) 487-3358.
Circle No. 132

CP/M Integrated Business Software

An integrated Order Entry, Accounts Receivable and Inventory System, targeted at wholesale and manufacturing companies, is available from Arkansas Systems, Inc.

The Order Entry System writes invoices, adjusts inventory and charges the items to Accounts Receivable, which passes the activity on to General Ledger. Order Entry takes the bill to/ship to address from Accounts Receivable, taxable status, price to use (4 available) and other information. As invoice line items are attached to the order, the description, price and other information is taken from Inventory.

In addition to the three systems, ASI also has available General Ledger, Payroll, and Accounts Payable Systems.

Designed to be run in any state/province/country without modifications, the systems are flexible, well documented and ideal for a first-time end user, the company said.

The software packages, written in FORTRAN and provided on 8-inch CP/M compatible disks, require 32K of memory with the exception of the Order Entry and Inventory Systems which require 48K. The cost of each system is $700 and manuals are provided for each package. For more information contact Arkansas Systems, Inc., 8901 Kanis Rd., Suite 206, Little Rock, AR 72205; (501) 227-8471.
Circle No. 101

DYNACOMP

Quality software for: Apple II Plus
TRS-80 (Level II)
North Star

All software is supplied with complete documentation which includes clear explanations and examples. Each program will run with standard terminals (32 characters or wider) and within 16K program memory space. Except where noted, all software is available on North Star diskette (North Star BASIC *or* Microsoft BASIC for those North Star systems running under CP/M), TRS-80 cassette (Level II) and Apple cassette (*Applesoft* BASIC). These programs are also available on *PAPER TAPE* (Microsoft *BASIC*).

FLIGHT SIMULATOR
(as described in SIMULATION, Volume II)
A realistic and extensive three-dimensional simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers.

Price: $17.95 postpaid
SIMULATION, Volume II (BYTE Publications): $6.00

VALDEZ
A simulation of supertanker navigation in the Prince William Sound and Valdez Narrows. The program uses an extensive 256X256 element radar map and employs physical models of ship response and tidal patterns. Chart your own course through ship and iceberg traffic. Any standard terminal may be used for display.

Price $14.95 postpaid

BRIDGE 2.0
An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice.

Price: $17.95 postpaid

HEARTS 1.5
An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies.

Price: $14.95 postpaid

MAIL LIST I
A many-featured mailing list program which sorts through your customer list by user-defined product code, customer name or Zip Code. Entries to the list can be conveniently added or deleted and the printout format allows the use of standard size address labels. Each diskette can hold approximately 900 entries.

Price: $18.95 postpaid (available for North Star only)

TEXT EDITOR I (Letter Writer)
An easy to use, line-oriented text editor which provides variable line widths and simple paragraph indexing. This text editor is ideally suited for composing letters and is quite capable of handling much larger jobs.

Price: $14.95 postpaid

COMPRESS
Make your BASIC programs run faster and use less memory! In many cases you can reduce the size of your programs by 30% or more, while improving execution speed by a comparable amount. Save money by storing more programs on each diskette or cassette.

Price: $9.95 postpaid

GAMES PACK I
Seven entertaining games for less than a dollar a kilobyte! Play CATAPULT, CRAPS, SWITCH, HORSERACE, SLOT MACHINE, BLACKJACK and LUNAR LANDER. This is an excellent way to introduce your children to computers.

Price: $10.95 postpaid

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CIRCLE 14

Intermediate Language for CP/M Systems

An interactive compiler and loader program for CP/M compatible, 8-inch, single density disks is available from Interactive Microware, Inc.

Basex includes extensions to allow full use of all CP/M operating system facilities and include commands to save and load complete files and list disk directories.

Basex is an intermediate-level language for microcomputers that combines features of both BASIC and executable machine language code. It is almost as easy to use as BASIC and is nearly as fast and versatile as assembler language, the company said. The 8K Basex compiler is fully interactive and allows you to enter, list, edit, and run your program without the help of auxiliary programs such as editors or linkage editors. Programs run up to 20 times faster than similar BASIC programs. Most programs that would normally have to be written in assembler language can be written more easily in Basex. Also, the Basex run-time routines are only 2K bytes long, and typically require approximately 6K bytes less memory than similar programs run with an 8K BASIC interpreter.

Most Basex commands resemble their counterparts in BASIC which speeds up translating programs from BASIC to Basex. Most of BASIC's features such as array variables, text strings, arithmetic and logical operations are available to Basex users. In addition, Basex allows variable names of any length, block memory searches, block memory transfers and named subroutines that can pass multiple arguments to and from the calling program. Although Basex does not support floating point number calculations or trigonometric functions, it is easy for you to add new functions for custom applications, the company added.

The Basex user manual includes documented listings of the compiler written in Basex and execution routines written in 8080 assembler language. The 97-page manual, 17-page CP/M addendum and 8'' CP/M disk are available for $43. The manual alone is $8. For more information contact Interactive Microware, Inc., P.O. Box 771, State College, PA 16801; (814) 238-8294. *Circle No. 112*

Disk File Sort for Apples

An enhanced version of a machine-language disk-file sorting program compatible with either the Apple II or the Apple II Plus is being offered by Datacope.

The new version of the Datacope Single Disk Sort is easier to use and stores information about your frequently sorted files on the diskette, the company said. The program performs a specified direct command upon completion of the sort which allows use in turn-key systems.

The program uses one disk drive and sorts a single file of fixed-length records on one diskette. The file may fill the entire diskette because the DSDS does not use any workspace on the diskette. In addition, any block of consecutive records may be sorted without disturbing the remainder of the file.

The file, which may contain records as long as 5000 characters each, may be sorted by a maximum of ten key fields simultaneously, with each key field in either ascending or descending alphabetical or numerical order. The key fields must be in fixed positions in the records and may not overlap. There may be a total of 256 characters in all the key fields.

The package includes a manual and a diskette with the sort programs, a test file, and test file access programs in Applesoft II for $49.95. For more information contact Datacope, P.O. Box 55053, Hillcrest Station, Little Rock, AR 72205. *Circle No. 138*

Financial Planning System

Desktop/PLAN, a software system for the Apple II, allows you to develop and operate customized business planning and analysis systems with no programming knowledge.

Designed to perform functions similar to planning systems operated on many time-sharing computers, Desktop/PLAN allows you to describe reports and calculation requirements for planning or analysis in terminology familiar to most business people.

Desktop/PLAN sells for $95. It operates on an Apple II with at least 32K of memory, a disk drive and a printer. Total cost to the user, including hardware and software, will vary between $3500 and $6000 with the average about $4000. The software is available from most Apple dealers. For more information contact Desktop Computers, Inc., 5276 Hollister Avenue, Santa Barbara, CA 93111; (805) 964-9749. *Circle No. 105*

25 Programs to a Bushel

Apple Barrel Bushel #1 is a collection of 25 programs that has something to offer the veteran Apple user as well as those who have just bought their first system. Program titles include Mortgage Loan, Days Between Dates, Calendar, Savings, Checkbook, Addition, Subtraction, Multiplication, Division, Metric Conversion, Luna C, T, or L, Apple LeMans, Alien, Think, Mountain, Black Hole Chase, Demolition Derby, Pacifier, Shape Builder, Plot, Menu Utility, Screen Print and Music Utility.

The package is available on cassette tape for $24.95 or disk for $29.95. For a demonstration, see your local Apple dealer or contact Computer Data Systems Corp., 550 N. Main St., Logan, UT 84321; (801) 753-6990.
Circle No. 145

Software Library for TRS-80

A library of TRS-80 software is being offered by Interactive Microware, Inc. Programs currently available are:

- Basex Compiler, a powerful, easy-to-learn language that runs up to 20 times faster than BASIC. The 8K interactive compiler works much like BASIC and makes compact programs (only 2K runtime overhead). Features include arrays, strings, 16 bit math, block move and search, routines with multiple arguments, fast graphics and tape I/O.
- Mirrorays, a game with many variations in which you

flash rays of light into a black box in order to locate hidden mirrors that light up and relfect the rays when hit. The computer will hide the mirrors or you can position them yourself to baffle an opponent or set up trick shots.

• Compact Graphics Interpreter creates elaborate graphic designs with a simple set of numbers. It is written in BASIC, requires less than 4K memory, and is quick to code and easy to modify.

• Lunar Lander Simulator provides real-time simulation and control of the Lunar Module through continuous keyboard interaction. Module movement and instrument panel are displayed through high-speed language graphics.

• Battlegrid, a real-time game of speed and strategy, enables two players to attack each other's forces. The number, type and size of battle pieces can be specified by the players, providing unlimited game possibilities. The game features high speed machine language graphics and continuous input action by both players (4K).

All of the programs operate on a 16K Level II TRS-80 and sell for $7.95 except the Basex Compiler which sells for $25 plus $8 for a 97-page manual. Price includes a cassette, plastic case and instruction manual. For more information contact Interactive Microware, Inc., P.O. Box 771, State College, PA 16801; (814) 238-8294. *Circle No. 153*

Utility Program for the Apple

A utility program Slow List/Stop List for the Apple has just been published by Hayden Book Company, Inc.

With Slow List/Stop List you can start, stop and control the speed of the listing with Apple II's game paddles. You can also control the speed at which the disk catalog appears and terminate the Catalog operation in the middle. The program can be enabled and disabled under software control.

The program is priced at $19.95. For more information contact Hayden Book Company, Inc., 50 Essex St., Rochelle park, NJ 07662; (201) 843-0550. *Circle No. 128*

Apartment Management System

An apartment and rental unit management system for TRS-80 systems is offered by National Software Marketing, Inc. The system is designed to operate with tape or disk systems with or without a printer.

With the software, you can randomly access any unit, scroll through all units and modify and update all files. The package produces delinquency reports; lease expirations reports; maintenance reports; rentroll with last rent paid, security deposit, and annualized rent; and listing of tenants with children and pets. The tenant file contains all necessary data including comments and maintenance record. The system can accommodate multiple units.

A cash journal system supplied with the system provides you with an operating record of operations and cash balances. The system, supplied on disk or tape, sells for $99 plus mailing charges. For more information contact National Software Marketing, Inc., Box 6195, Hollywood, FL 33021; (305) 961-4888. *Circle No. 116*

ANNOUNCING

TRS-80
PEOPLE'S PASCAL

"Tiny" Pascal, runs on any 16K Level II system, includes the programming structuring capabilities of full Pascal, but not data structuring.
Compiled People's Pascal programs run about five-times faster than Level II Basic — graphics run eight-times faster.

People's Pascal Tape 3 .....$15.50
(program development system, in 7 programs, 3 in Basic. Requires T-Bug and editor/assembler)
People's Pascal Tape 6 .....$23.50
(easier to use — entire development system loads at once — written in machine language)
Prices to CA residents $16.40 and $24.88 (sales tax).
Dealer inquiries invited.
Other People's Software tapes $8 ($8.45 CA)

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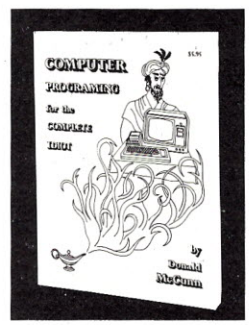
CIRCLE 21

Create Your Own Programs



Custom programs are the best way to ensure that your computer does what you want. "Computer Programing for the Complete Idiot" simplifies programing by describing a format that shows how to organize BASIC into meaningful programs that achieve specific tasks. A Payroll Program is used as an example. Detailed instructions then show how to apply this process to creating original programs.

Featuring the TRS-80, this book uses the ANSI minimum standard BASIC so it may be used easily with other computer models.

An excellent guide for the beginner with many useful references for the advanced programer.

ONLY $5.95 - 128 PAGES

Please send me ___ copies of "Computer Programing for the Complete Idiot" at $5.95 each plus $1.00 for shipping. (California residents add sales tax of $0.36 per book.)
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CIRCLE 20

Apple File System Compresses Data

Alpine Software has released an Apple II file management system, called Apple-FMS, oriented to business applications that need to store more data than the 100K bytes a normal Apple Disk II will store.

Strings of up to 255 bytes of the same character such as a space or a zero are compressed into two bytes. A typical application such as a payroll record often contains fields for miscellaneous deductions that are zero for most of the personnel in the payroll. With FMS the fields would be compressed into two bytes when the record was written to the disk, resulting in a disk savings of up to 90% in some applications.

If one disk will not hold the entire file: Alpine offers a multi-volume, multi-drive disk version of FMS which will handle files that require up to 12 drives and up to 255 volumes.

A Corvus Disk version of the software allows files to be written which span the entire 82 volumes of the disk.

FMS allows variable length records of any size up to 8192 bytes, and record keys from 1 byte up to the length of the record. Disk I/O is minimized due to a single index block structure which requires a maximum of one disk access to fetch a record, since the index block is in core at all times. You can allocate as much core as you desire to a given file so that many data blocks can be in core at the same time to minimize disk activity.

FMS is written entirely in Apple II machine language, resulting in fast access to records and low CPU utilization. Utilities are provided for moving and comparing data strings.

Alpine offers FMS at the introductory price of $195; the multi-volume, multi-disk version is $295; and the Corvus Disc version, $395. A user's manual with sample application programs is included or available separately for $10. For more information contact Alpine Software, Inc., 4874 Ridenour Drive, Colorado Springs, CO 80916; (303) 591-9874. *Circle No. 134*

Inventory Control System

INV-V, an inventory control system for 32K TRS-80 disk systems, is designed to provide control functions to allow you to maintain an efficient inventory system with improved service at low investment costs by providing order strategy and tools to measure performance. The system, from Micro Architect, is on-line, interactive, menu-driven and human engineered.

"Order report" gives you all the inventory items at or below the safety levels and the associated order information such as order quantity, vendor code and the total amount in dollars. The system also indicates priority to order: for example, order out-of-stock items first, high-profit items next and then high-usage items.

"Performance report" includes the tools to measure the efficiency of the inventory system and associated costs. A summary of your system will include the total inventory cost, total number of out-of-stock items and over-stocked items.

Other reports include "data base lister" and "end-of-year processor" which also calculates economical order quantity and compares the EOQ to the current order quantity.

In addition, a report writer is provided to allow you to specify unlimited report formats on-line without programming. Up to ten formats specifications can be saved to disk at one time.

A 9-character alphanumeric key is used for fast, keyed, random access. Other features include form input, live keyboard, audit log, automatic page numbering an simulated form feed.

The INV-V package is priced at $99, which includes postage, a program disk, a data disk and a 24-page manual. The program has been field tested and is ready for immediate shipment. Send $5 for the manual alone. For more information contact Micro Architect, 96 Dothan St., Arlington, MA 02174. *Circle No. 120*

North Star Statistics Package

Microstat, an advanced statistical package designed for serious scientific, research and business applications, is specifically designed for use on 8-bit computers. The package uses special algorithms designed to minimize errors introduced into many statistical calculations when large numbers are used.

Microstat utilizes a Data Management Subsystem (DMS) to control, edit and modify all files that are used as data input into the system. Among other functions, DMS permits up to 11 data transformations on any data file, including reciprocals, exponential and linear transformations, plus the ability to augment, rank order, sort and lag variables in the data file.

In addition to DMS, Microstat also features 8 probability distributions, 11 non-parametric tests, Chi-square, one and two-way ANOVA, hypothesis tests (mean and proportions), simple and multiple regression, time series (including exponential smoothing), data plots plus other tests and features.

A user's manual, which includes sample data and printouts, is available for $10 and may be credited towards Microstat's purchase price of $200. The package is designed for use with the North Star Disk Operating System and BASIC, one or two drives. For more information contact Ecosoft, P.O. Box 68602, Indianapolis, IN 46260; (317) 253-6828. *Circle No. 152*

Keyword Indexing Package

A TRS-80 based, keyword indexing system for searching and accessing data or text records stored on disk has been developed by Northeast Microware. The package offers a method for accomplishing the job of cross-referencing information.

The Keyword Indexing package is a series of programs that enable you to create a disk data file, build an index of all occurrences of "Keywords" in the file, and inquire into that file using any combinations of keywords. Additionally, the records in the data file can contain data that is not scanned for keywords but is displayed when an inquiry is done. The system also allows reference pointers to be included in the

records which can be used for chaining to other files or pointing to actual locations in the office or home.

The heart of the package is the inquiry capability. The inquiry program enables you to access the data file through the keyboard by entering combinations of words to search on. The package also includes a series of access subroutines which can be included in your program. This enables you to write your own inquiry programs in BASIC if you wish. Both the inquiry program and the subroutines allow "and," "or" and "not" logic and generic or partial words to be used when accessing the data file.

The Keyword Indexing package can be used for a variety of applications where searching of data or descriptive information is required. Some potential applications are to index and search technical magazine articles or papers, photo descriptions, poison or disease symptoms, recipes, calories or nutrition information.

The package requires two disks and 32K of memory. It is available for $39.95. For more information contact Northeast Microware, P.O. Box 6153, Syracuse, NY 13217; (315) 637-6953. *Circle No. 118*

Word Processing System

The WpDaisy word processor, which enables a variety of microcomputer systems to become word processing systems, has been released in a new version by InfoSoft Systems, Inc.

The package — the original version of which has been marketed since May 1978 — has been updated to include additions and enhancements, and an improved manual, the company said.

The systems can be effectively used with a combination of almost any CRT terminal, 8080/Z-80 disk-based CPU, and letter-quality printer, the firm added.

In using the system, you can change diskettes, list directories of all disks in the system, write files to any disk in the system, and review any file on the CRT screen. The system also creates back-up documents automatically. All or part of any text can be moved to any disk under a selected file name, either as is or formatted.

The text editor and document formatter facilitate the creation of documents, easy revision, and full preview on the CRT screen. In addition, documents and manuscripts can be fully justified when a letter quality printer is employed.

Among features to the text editor are status message, buffer usage, file content, and command summary displays; vertical scrolling; find/replace, on screen insert, and line and word delete functions. Format additions include auto hyphenation, operator pause, tab ruler, and special printer capabilities such a boldface and red print.

For a limited time, the package will contain — without additional charge — Mailmerge, a form letter and mailing label generator.

The package has a retail price of $450, which includes full text editing and format processing functions. The text editor (called "Daisy") is available by itself for $125. For more information contact InfoSoft Systems, Inc., 25 Sylvan Road South, Westport, CT 06880; (203) 226-8937.*Circle No. 151*

Advanced Statistical Analysis

Advanced Statistical Analysis, a system of computer programs designed for the analysis of data in business, education, medicine, government administration and other fields, is available from Radio Shack for a 16K Level II or Disk BASIC TRS-80.

The system consists of 13 computer programs stored on cassette tapes, and a comprehensive manual which takes you through the programs step-by-step. Each program was written to be interactive and to guide you in conducting statistical analysis.

Included in the system are ten programs for describing data sets and conducting statistical data analysis; two utility programs for preparing, updating, and listing data files stored on tape or disk; and a program to aid in selecting data samples.

Programs supplied with the Advanced Statistical Analysis system are: Tape Data Files, Disk Data Files, Random Sample, Descriptive Statistics, Histogram, Frequency Distribution, Analysis of Variance, T-Test for Matched Pairs, Correlation and Linear Regression, Mulitple Linear Regression, Time Series Analysis (two programs), and Chi Square Analysis.

Advanced Statistical Analysis is available for $39.95 at Radio Shack stores and computer centers. For more information contact Radio Shack Computer Customer Services, 205 N.W. 7th Street, Fort Worth, TX 76106; (817) 390-3272. *Circle No. 146*

Graphics Drawing System for Apple II

The VersaWriter, a digitizer and software drawing package for the Apple II providing high resolution and mass color graphics comparable to the quality of the Apple, has been announced by Rainbow Computing, Inc.

The VersaWriter permits a variety of applications for many different types of users including artists, engineers, teachers and students, and business people. When used as a pointer, the VersaWriter can direct movements of objects on the video screen, for game playing or creating graphics. As a digitizer, the VersaWriter provides a means of inputting graphical data for analysis, for flow charts and diagrams. You can create drawings, architectural plans, schematics charts and graphs at will, and store or change them as desired.

Sixteen commands control movement of the cursor, permit fill-in coloring using 6 colors, horizontal and vertical scaling, centering on the screen, storing and recalling to and from disk, and more.

The complete system consists of the VersaWriter drawing board and interface, diskette software, calibration chart and instruction manual. The drawing board plugs directly into the game I/O. An Apple with Disk II, 32K of memory and Applesoft ROM is required.

The normal retail price of the VersaWriter is $199. However, Rainbow Computing is offering the product at the introductory price of $179.95 while initial supplies last. For more information contact Rainbow Computing, Inc., 9719 Reseda Blvd., Northridge, CA 91324; (213) 349-5560. *Circle No. 144*

More than a Catalog

Creative Publications' new full-color catalog is more than a great catalog of computer products selected for education. It's a magazine featuring articles on educational computing and classroom activities. We made it a visually exciting introduction to the world of computers in learning. We're bringing it out twice a year to keep up with this changing field. And we'll send it to you if you drop us a line.

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CIRCLE 25

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WHAT'S COMING UP

General Ledger System

GLector, a general ledger system by Micro-Ap to run with the Selector III-C2 Information Management System, uses transaction codes for data entry which removes the need to memorize account numbers and whether credits or debits are to be applied.

GLector manages 24 months of data and allows any account balance for any month of the current fiscal year to be instantly updated. Prior month account balances are easily entered with GLector automatically computing asset, liability, capital, revenue and expense sub-totals and totals. Financial statements can be generated for any period of the current year including the current unposted month. Balance sheets show current and last year balances as of any month. P and L reports incomes for any period (i.e., September to July), YTD's, percents of sales for both current and last year, and percent change of current period from last year's period. The package includes sample chart of accounts and chart of transaction types.

GLector, which requires a 52K CP/M compatible operating system, CBASIC Version 2 and Selector III-C2, is priced at $250. For more information contact Micro-Ap, 9807 Davona Drive, San Ramon, CA 94583; (415) 828-6697. *Circle No. 127*

Diagnostic Memory Tests

Memdoc is a user interactive memory diagnostic for 8080, 8085 and Z-80 systems. Written in assmebly language, it is intended to be used by both the technician who repairs memory systems and by the general user who wishes to qualify memory periodically.

There are 14 tests and six combinations of tests, any of which can be selected by a single command. An oscilloscope loop enables a technician to efficiently isolate problems. A manual relates Memdoc to memory testing.

Memdoc object code is available on single density North Star diskette for $34.95. A hexadecimal image dump is available ready for entry for $34.95. Either variation contains Memdoc assembled at five starting addresses, and comes with the manual. For more information contact Eagles Computer Works, P.O. Box 22664, Denver, CO 80222. *Circle No. 130*

Program Verifies Apples Tapes

The Applesoft Tape Verifier will provide either an Apple II or an Apple II Plus with the ability to verify programs saved to cassette. The program remains resident in the computer as long as power is applied and the computer is in the Applesoft mode.

In addition to working on both types of Apple computers, the Applesoft Tape Verifier also works with both RAM or ROM Applesoft.

The Applesoft Tape Verifier costs $20 and is supplied with an Apple-compatible cassette. For more information contact Softsell Associates, 2022-79th St., Brooklyn, NY 11214. *Circle No. 131*

Now You Don't Have to Wait for the Best

It's new. And it's a book that every microcomputerist should have. It's Volume I of **The Best of Personal Computing.**

Comprehensive check writing and accounting, stock market analysis, inventory control and vacation planning are only a few of the valuable computer programs contained within.

These programs, collected from two years of Personal Computing magazine, will run on most popular microcomputer systems.

Just using one computer program could easily be worth more than the $7.50 purchase price of the softcover 8-1/2″ × 11″ book of 196 pages.

Some of the other programs well received over the last two years and reprinted here include: Investment Analysis to help decide highest profit potential, Contract Labor Cost Accounting, Calculation of Seasonal Indices, Computerized Phone Directory, Use of Sensing and Control Devices in the Automated House, Personal Budget Control and Automatic Data and Appointment Reminder.

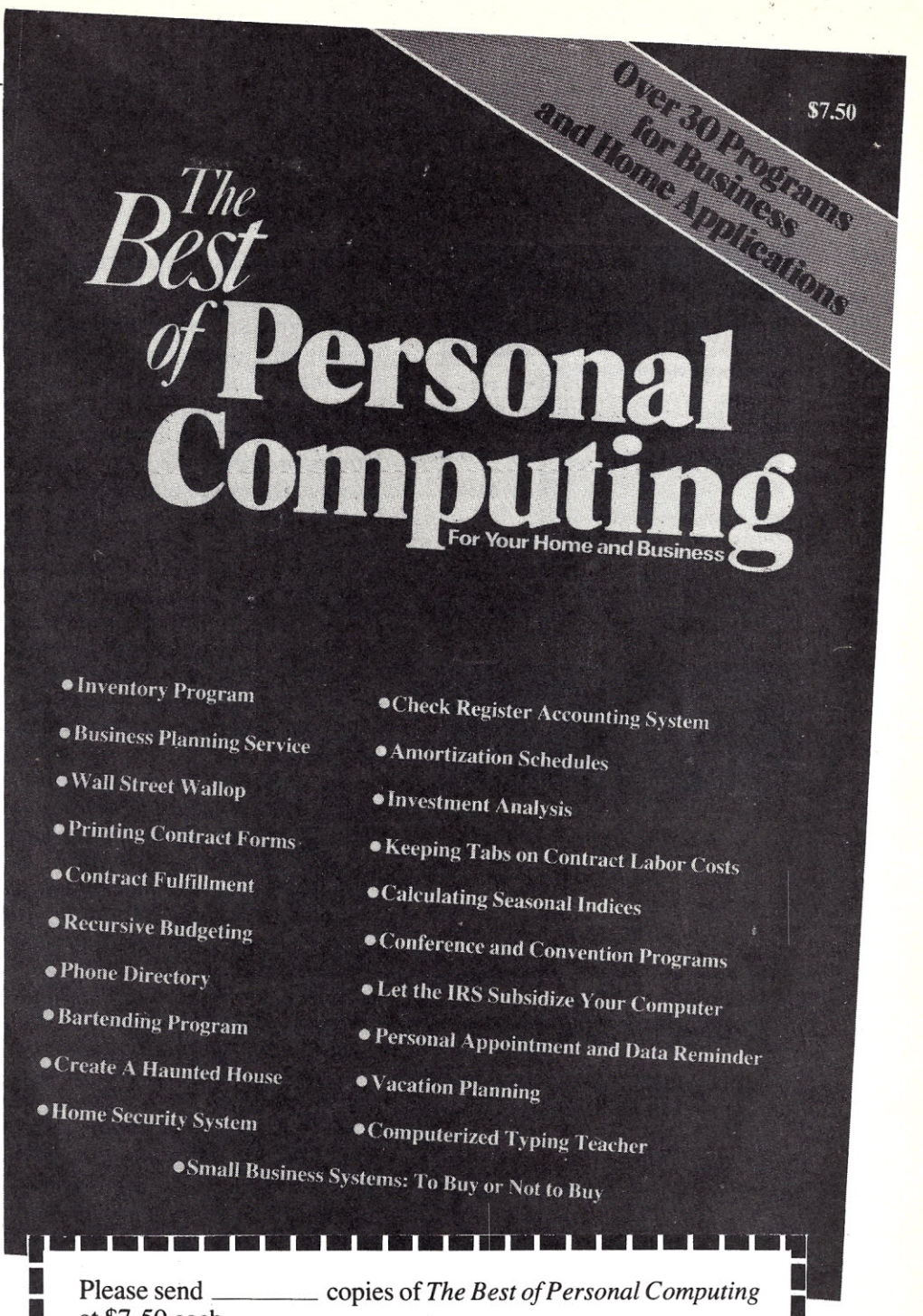
Programming students will find the program listings (mostly in popular BASIC programming language) an important aid to understanding and learning more about practical computer programming.

In total there are more than 20 applications with 30 program listings: 10 are applicable to both business and home use, 17 to business use, and 5 directly to home use.

One special feature of the book is the artcile "Small Business Systems: To Buy or Not to Buy", which takes the reader step-by-step through the question he should ask himself, manufacturers and retailers before buying a computer system.

The Best of Personal Computing Volume I, is available for $7.50 (Postage included) from **Personal Computing,** Box AD, 1050 Commonwealth Ave., Boston, MA 02215. Payment must accompany your order.

Treat yourself or a friend to a gift that will be appreciated for its usefulness — The Best of Personal Computing.



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CIRCLE 28

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Apple Acts Like Typewriter

Products which allow entry of upper and lower case alpha using the shift keys as on a conventional typewriter, have been built around a hardware-software modification of the Apple II by C&H Micro. You do not need to be limited to upper case only, to using keys such as escape or control in place of the shift keys, or to expensive boards. A one-wire modification with one solder point gives you the use of your shift keys. An Inverse mode option is included and the software is compatible with general display techniques which display ASCII correctly such as Paymar's LCA and Apple's contributed High Resolution Character Generator.

The Keyboard Expandor hardware-software modification transforms your Apple II into a complete U/L system. Cap and shift locks are included; all Apple characters and Monitor editing functions are maintained. Software is transparent to the user and compatible with DOS. U/L case can be used in TEXT files, in PRINT and REM statements with BASIC programs, in DOS file names and in Immediate mode.

Textpage contains both Keyboard Expandor and an Integer BASIC program called Textpage. This program was part of the firm's Appleshift package. Originally meant as a demonstration of how to use the Appleshift subroutines, the package uses binary files for storage and gives limited "page--processing" capabilities which allow entry, editng, storage and printing (using your own printer driver) of a "typed page" (55 lines of 80 characters). The package requires a 24K DOS system.

Chapple, a complete word processing system, includes Keyboard Expandor and a full screen editor. Keyboard Expandors, Appleshifts, and Textpages may be returned for full credit toward Chapple.

C&H Micro also offers schematics and software, called Real Time Clock, for serially interfacing your Apple II to a real-time clock through 3 pins on the Game I/O Connector using approximately $15 in parts.

All products contain a disk with copies of routines (except the Real-Time Clock) and documentation describing the hardware modification and use of the routines. Orders should be accompanied by certified check or money order. The Keyboard Expandor is priced at $20, Textpage at $30, and Real-Time Clock at $5. The price for Chapple may be obtained by writing to the company. For more information contact C&H Micro, P.O. Box 249, Clifton Park, NY 12065.
Circle No. 129

TRS-80 Printer Controller

National Software Marketing, Inc., offers a printer timer that works with the TRS-80 and the Centronics 779 line printer.

The device turns the printer on and off automatically using signals sent over the printer cable. The device requires no software or hardware modification other than soldering three wires and mounting the timer inside the printer cabinet. The timer is encapsulated for durability.

Benefits of the timer include less motor wear and tear and quieter operating environment, the company said.

The timer is shipped prepaid anywhere in the USA for $95. Shipping delays are approximately two weeks. A catalog of NSM hardware and software is free. For more information contact National Software Marketing, Inc., P.O. Box 6195, Hollywood, FL 33021; (305) 961-4888. *Circle No. 119*

Computer-theme sculptures

Gold-finished plaster sculptures to be used as paperweights or conversation pieces for desks or computer rooms are available from Brian productions. The company said two sculptures make good bookends. The hefty, six-inch long items come in five styles and feature: "I love My Computer," "I Hate My Computer," "I Love My NCR Computer," "I Love My System/3," and "I Love My IBM Computer."

Statuettes are priced at $6.95 each including shipping costs. For more information contact Brian Productions, 2949 Southfield Rd., Xenia, OH 45385; (513) 426-8277.
Circle No. 137

Floppy Disk Saver Kit

Mini floppy disks and programs are expensive. Losing programs and mini floppy disks due to damaged center holes is even more expensive. Floppy Saver is a reinforcing ring of 7-mil mylar with adhesive backing. With aid of a special tool (provided) you can put rings on every disk you own. Floppy Saver will save disks already damaged and will protect new disks for many times normal life, the company said.

A complete Floppy Saver kit consists of a special centering post, pressure tool and supply of mylar reinforcing rings. Retail price for the kit is $14.95. VISA or Mastercharge accepted. For more information contact Tri-Star Corporation, P.O. Box 1727, Grand Junction, CO 81501; (303) 243-5200. *Circle No. 104*

Voice I/O Terminal for Sorcerer

Voicetek Inc.'s Cognivox unit for computer voice input/voice response plugs into your Sorcerer computer and offers a 16-word recognition vocabulary plus voice response with up to 16 words or phrases. The self-contained unit includes a microphone and amplifier/speaker.

A software library, provided with Cognivox, includes Voicetrap, a voice operated video game, and Vothello, a voice input version of the game Othello. A talking calculator program allows using your Sorcerer as a four-function calculator without looking at the CRT screen. A vocal memory dump program can read out loud its memory in hexadecimal format.

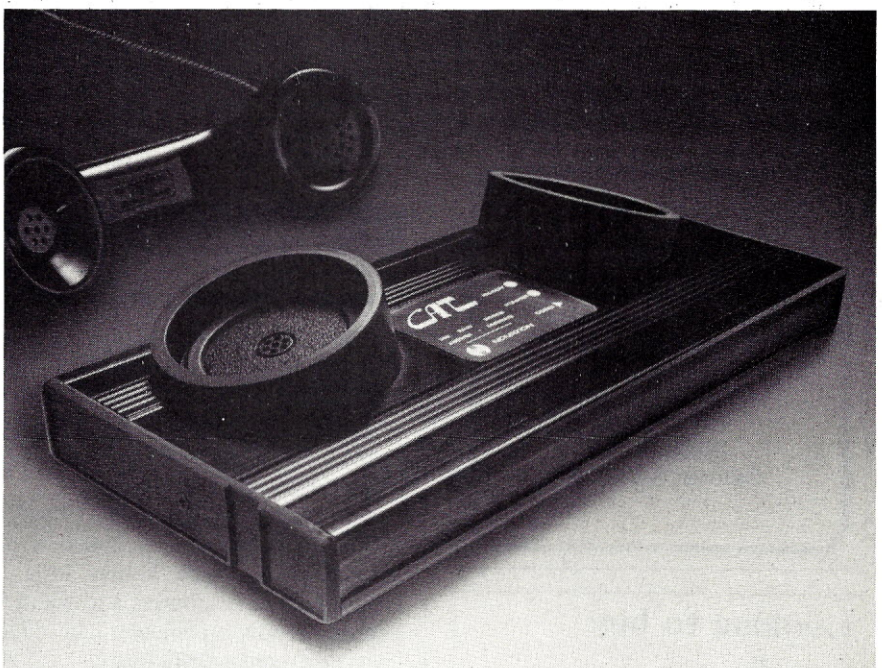
Cognivox is priced at $149. Availability is off the shelf. For more information contact Voicetek, P.O. Box 388, Goleta, GA 93017; (805) 685-1854. *Circle No. 133*

Reserve Power Supply

Application of computers (especially in business environments) requires protection against program interruption and data loss due to power "flickers," brownouts and prolonged outages. High Technology, Inc., now offers the Applejuice reserve power supply to provide protection against power losses for the Apple, including European versions of the computer.

So that the system may be brought to a controlled stop, Applejuice provides a visual, audible and electronic signal output to alert you or the computer when a power failure is occurring. Power supply backup time is approximately 15 minutes.

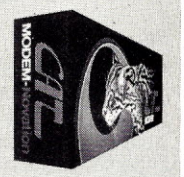
Suggested retail price of Applejuice is $249. For more information contact High Technology, Inc., 1611 N.W. 23rd Street, Oklahoma City, OK 73106; (405) 528-8012. *Circle No. 122*



Basic Cat™

A Cat acoustic modem lets your computer talk face to face with any other compatible computer or terminal within reach of your phone. It takes the data you type into your terminal and sends it out over standard telephone lines. It's that simple.

Talk to your office computer from home. Send or receive data from anywhere. Swap programs in Basic, Pascal, Fortran, Cobol or whatever—it doesn't matter to Cat. It's the accurate, reliable, affordable (under $199) modem that talks your language.



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WHAT'S COMING UP

Diskette Storage System

Computer Resources Company offers a four-sided revolving diskette storage and retrieval stand that gives finger tip access to up to 64 standard 8≦ square, or 48 mini 5-1/4≦ square diskettes.

The welded, steel-constructed unit revolves on a felt-padded, ball bearing base and is cloud white in color. The standard size unit retails for $115, and the mini sized unit for $97.50 each. For more information contact Computer Resources Company, Suite 1500, 2 Penn Plaza, New York, NY 10001; (800) 523-9350. *Circle No. 140*

LITERATURE

Program Helps Business People

A program designed to give the small businessperson the information and understanding needed to evaluate how a computer can benefit a business was announced by Heath Company, a subsidiary of Zenith Radio Corp.

The program, "Computer Concepts for Small Business," is aimed at the businessperson who knows little or nothing about computers and wants to determine how a computer can reduce costs and increase efficiency.

The package includes three audio cassettes and uses audio-tutorial teaching techniques. The cassettes guide the reader through the text material, highlighting important points. A 160-page illustrated workbook describes the types of memory in a computer, compares the capabilities of different types of storage media and I/Os and discusses the types of software and the tasks they can be designed to perform in a typical small business.

The program covers the types of personnel needed to run a computer, how to set up a data processing department in your office, what to look for in a good data processing manager and the advantages of time-sharing, service bureau and owning, and compares the types of computers and how to select the one that best serves your needs.

"Computer Concepts for Small Business" is priced at $49.95. For more information contact Heath Co., Dept. 350-970, Benton Harbor, MI 49022; (616) 982-3417. *Circle No. 141*

New Computer Book Catalog

A new catalog featuring selections of computer and computer-related titles has been released by Howard W. Sams & Co., Inc.

Organized into five areas—Basics, Programming, Computer Technology, Reference and Computer-Related—the catalog details books directed from the home hobbyist to the technically-oriented professional.

The books, written by professionals, feature photos and illustrations.

Microcomputer Primer, Your Own Computer, and *How to Buy and Use Minicomputers and Microcomputers* are several titles included in the "basics" of computer technology section.

Such titles as *How to Program Microcomputers* and *6502 Software Design* are included in the programming section.

Thirty-two titles, ranging from *Microcomputers for Business Applications* to *TRS-80 Interfacing,* are in the computer technology category. The *Computer Dictionary and Handbook* is featured in the reference section.

In addition, twenty computer-related titles, covering such subjects as CMOS, TTL, and ICs, are included.

Copies of the catalog are available free of charge from Howard W. Sams & Co., Inc., 4300 W. 62nd Street, P.O. Box 558, Indianapolis, IN, 46206; (317) 298-5400. *Circle No. 143*

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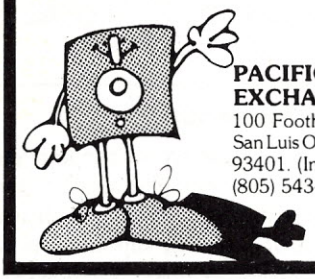

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Turn to page 93 for details on how you can

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CIRCLE 41

Sort Subroutines for Microcomputers

Creative Computer Consultants Inc.'s Volume 4—Sortmaster in the Standard Software Library contains listings of five BASIC subroutines designed to sort numeric data in memory for TRS-80, Pet and Apple computers. The sorting techniques used in the routines are often used in large mainframe computers for high volume sorting.

The subroutines were designed to be integrated into your main line program. Any numeric field in your record may be sorted by designating that field as the sorting key, making it possible to sort records of any length and permitting multiple sorting keys as well. All the routines can handle alphanumeric data if you adjust variables.

In addition to program listings, Sortmaster includes an introduction to basic sorting concepts useful to beginners, the company said.

The Sortmaster volume is available at $8.95. For more information contact Creative Computer Consultants, P.O. Box 2111, Norwalk, CT 06852; (203) 847-0141. *Circle No. 154*

Microcomputer Add-Ons

Microcomputer Technology, Inc., and Apparat, Inc., two distributors and developers of add-on hardware and systems software for the TRS-80 and other microcomputers, have published a new catalog. The catalog is a formatted reference guide to a line of mini-floppys, line printers, software and other accessories for use with the TRS-80 and other microcomputers.

Illustrated for easy access to information, the catalog provides descriptions of each product type with brief application notes. Also included is a new line of manufactured products, such as printer and floppy cables, power supplies with cabinets for the mini-floppys, and isolators.

The catalog is available free. For a copy or more information contact Microcomputer Technology Inc., 2080 South Grand, Santa Ana, CA 92705, (714) 979-9923; or Apparat Inc., 7310 East Princeton, Denver, CO 80222 (303) 758-7275. *Circle No. 155*

Guide to Micro Supplies

A Buyers Guide to microcomputer software, accessories and supplies for the Apple II and the TRS-80 as well as a wide range of computer supplies is now available from Wallace Computers, Accessories and Supplies. Three hundred items are listed and the guide is updated monthly. In many cases items are in stock and ready for delivery.

The Buyers Guide sells for $3 but a certificate worth $3 off the first purchase is supplied with each guide. For more information contact Wallace Computers, Accessories and Supplies, Inc., 1024 West Willcox, Peoria, IL 61604; (309) 685-7876. *Circle No. 157*

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When our New York sales offices moved to 2 Park Ave. a few months ago, we experienced a few weeks of difficulty in receiving mail addressed to Benwill Publishing or *Personal Computing*. Some mail was returned to sender by the Post Office. But the problem has now been straightened out. The correct address of our New York advertising sales office is: Ms. Arlene Joseph, *Personal Computing*, 2 Park Ave., New York, NY 10016. (This address is for advertising sales only; editorial, subscription and executive correspondence should be sent to our Boston office: *Personal Computing*, 1050 Commonwealth Ave., Boston, MA 02215.)

Computer Materials for the Classroom

Creative Publications, a publisher of mathematics education materials, has released a full-color newsletter/catalog of computers in education which includes a feature story, two classroom computer activities and a series of educational products.

The company also publishes a 112-page catalog of mathematics enrichment materials for elementary, and junior and senior high schools.

The catalog contains articles on classroom computing and features teacher-oriented evaluations of products.

Creative Publications, in cooperation with Berkeley's Lawrence Hall of Science, is also offering a series of computer workshops at its Creative Teaching Center in Mountain View, CA. The classes include quick introductions to microcomputers, BASIC for beginners, and two workshops for teachers on how to use microcomputers in the classroom.

In addition to a classroom, the Center features a display room which contains over 800 Creative Publications products. The firm has also recently opened a computer display room where prospective customers can try out software on various microcomputers, use the library of personal computing books and magazines, and inspect the books, posters and other computing products for sale.

For more information contact Barry L. Parr, computer activities advisor, Creative Publications, P.O. Box 10328, Palo Alto, CA 94303; (415) 968-1101. *Circle No. 156*

New TRS-80 Catalog

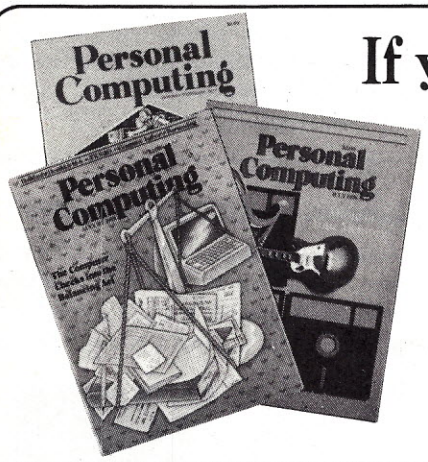
Radio Shack has issued its TRS-80 Microcomputer Catalog RSC-3, "The Expanding World of TRS-80."

The 24-page, full-color catalog includes information on both Model I and Model II systems priced from $499 for a Level I, 4K Model I to $8737 for a Model II Deluxe 2 Megabyte Business System.

Also listed are peripherals and accessories such as five line printers, disk expansion units, a voice synthesizer, system desk, dust covers, carrying cases and software including more than 50 ready-to-run programs.

Detailed specifications shown in the new catalog include a TRS-80 System Selection Guide, comparison charts for Level I and Level II BASIC, a description of disk BASIC and TRSDOS operatng systems for Model I, and the Level III BASIC and TRSDOS operating system for Model II.

TRS-80 Microcomputer Catalog RSC-3 is available free on request from Radio Shack stores, dealers and Computer Centers, nationwide. Contact Radio Shack, 1300 One Tandy Center, Fort Worth, TX 76102. *Circle No. 135*



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Screen Editing

Koch Computing, Inc., offers a firmware modification designed specifically for Hazeltine 1500 terminals. The modification gives the CRTs additional capabilities by offering two modes of operation: stock mode and block mode.

Stock mode allows a Hazeltine 1500 to operate as originally designed; block mode transforms the numeric pad into a screen editing control pad giving you screen editing capabilities that include up, down, left, right cursor control; insert/delete character in line; insert/delete line in screen; erase to end of line/screen; and block transmit of a single line up to 80 characters in length.

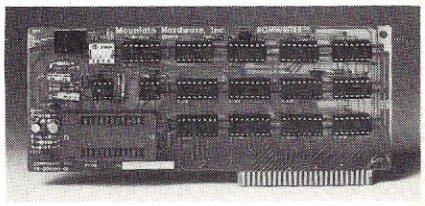
A triangular shaped cursor indicates stock mode operation while a block cursor indicates block mode operation. Changing modes of operation is accomplished by depressing the Shift key and striking the Block character on the keyboard.

The modification is available in kit form for $100 which includes postage and handling. The User's Manual can be obtained separately for a $2 postage and handling fee. For more information contact Koch Computing Inc., P. O. Box 160478, Miami, FL 33116; (305) 595-5491. *Circle No. 123*

EPROM Programmer for Apple

RomWriter from Mountain Hardware is an EPROM programmer permitting Apple owners to program 2K 2716 (5V) EPROMs. It can be situated in any peripheral slot, except #0. EPROMs to be programmed mount in a zero-insertion force socket, and all or part of the EPROM can be programmed and its contents verified without having to move the PROM to another location. An on-board switch will turn off power to the PROM so it can be inserted or removed without having to turn off the computer. A write protect switch is provided to protect programmed EPROMs while RUNning from the RomWriter board. A $CFF OFF switch is also provided to prevent execution of this command during programming or later when RUNning.

The diskette based software included with RomWriter permits virtually foolproof programming, the company said. You specify a start and end address in the EPROM and either a Disk File name or a starting address in memory. The

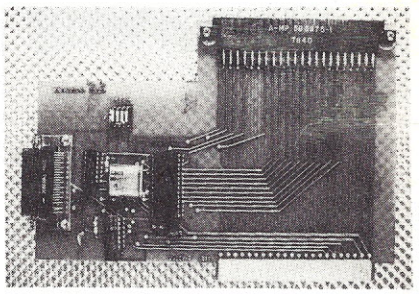


desired code will be BURNed, followed by a VERIFY. Additionally, existing EPROM code can be merged with desired changes to facilitate EPROM debugging.

Programmed EPROMs can be run while residing in RomWriter, or can be transferred to Mountain Hardware's ROMPLUS+ board. RomWriter sells for $159 including software package. Additionally, RomWriter may be purchased in a package with ROMPLUS+ ($149 separately) as Mountain Hardware's Firmware Development System for $300. For more information contact Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060; (408) 429-8600. *Circle No. 124*

Interface for AIM, KIM and SYM

A fully programmable RS-232 interface for AIM/KIM/SYM microcomputers allows you to connect a CRT terminal, printer, modem or any device



with an RS-232 interface port directly to the units. An expansion connector is provided, allowing you to further expand your system.

Unit price for the interface is $84.95 assembled and $69.95 in kit form. For more information contact Fobel Enterprises, 552 E. El Morado, Ontario, CA 91764; (714) 984-8871. *Circle No. 126*

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C4P MF: $1695 The ultimate portable computer has all the features of the C4P plus real time clock, home security system interface, modem interface, printer interface, 16 parallel lines and an accessory BUS. The standard machine operates at twice the speed of currently available personal computers (with GT option it runs even faster!). The C4P MF starts with 24K RAM and a single mini-floppy and can be directly expanded to 48K and two mini-floppies. Available software includes games, personal, business, educational and home control applications programs as well as a real time operating system, word processor and a data base management system.

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